BRITISH HONDURAS

ANNUAL REPORT

of the

DEPARTMENT OF AGRICULTURE AND FISHERIES

FOR THE YEAR

1969

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DEPARTMENT OF AGRICULTURE AND FISHERIES

ANNUAL REPORT

FOR THE YEAR ENDED 31st DECEMBER 1969

I. INTRODUCTION

POLICY

The basic policy of the Department remained the same:- namely

(I) To obtain the maximum degree of self sufficiency in respect of all crops and livestock products that can be economically produced within the country.

(II) To improve the quality, quantity, and range of export crops.

(III) To develop the livestock industry and promote export in the trade thereof.

(IV) To further develop the fishing industry and expand the range of export production.

(V) To conserve the natural resources

(VI) To promote farming as a way of life based on a sound system of agriculture.

(VII) To ensure the fullest possible integration between skill and capital inputs and indigenous farmers, and that national farmers participate actively in the agricultural development of the country.

2. British Honduras remains one of the few countries with such a high percentage of cultivable land awaiting development. To a certain extent the conditions which have in the past inhibited development, namely, poor communications both external and internal, a small internal market, and a dearth of investment capital and skills remains the same. Much of the high potential agricultural land has been held in private absentee ownership for many years without any development taking place. The introduction of the Rural Land Utilization Tax in January 1966 marked a major step forward in changing this state of affairs and its effects continue to be felt. The appearance of some large production units is a direct consequence of this law.

3. General Review:

The year 1969 was not a good crop year due mainly to high rainfall during the land preparation season. For the export crops sugar continued to be the largest export earner and the largest single factor in the economy. Although production was down by 18 percent from the 1968 crop of 63,558, prices rose almost enough to off set the production decrease. Citrus production rose in 1968/69, and prices were also up slightly, but adverse weather during the first half of the 1969/70 crop will undoubtedly affect the final figure. Cucumber exports to the U.S. passed the eight (8) million lbs. mark during the 1968/67 season. Some 243,000 lbs. of tomatoes were also exported during the same period. Banana production on the other hand declined when one of the exporters stopped harvesting.

On the domestic front production of corn and beans was roughly equal to demand with enough surplus corn to encourage investment in chickens and livestock. Although rice is still imported, roughly three (3) million pounds per annum, mechanical cultivation of

/rice in.....

rice in the Toledo and Belize Districts will, in a few years reverse that situation. There has been further investment in cattle and government sponsored auctions stimulated a raise in the prices cattle raisers obtained from butchers.

II WEATHER

1969 proved to be a very wet year. The rains came down on the 15th of May and continued till the month of November. The early coming of the rains prevented a number of farmers from their usual burning. Heavy and persistent rains during the latter part of August were followed on 2nd September by Hurricane Francelia and subsequent disturbances which quickly filled all the available storage capacity in Belize River and the Sibun River, for example, water levels were the highest in 10 years, at certain sections exceeding those observed during and after hurricane Hattie in 1961. Traffic from Hattieville to Belize City via the Burdon Canal Bridge was halted for a fortnight as long stretches of the highway in this vicinity were under water. In general, most of our farmers suffered great losses especially those farmers who plantations were next to river banks, as flood waters washed away their crops. (Notable is the fact that on the day of the hurricane, P.W.D. station at Machaca registered 9.01 inches of rainfall while the Belize International Airport recorded 2.96 inches. This was expected, for Toledo was the district that suffered directly the wrath of Francelia).

The month of December was exceptionally dry throughout the country. The Agricultural Station at Punta Gorda with a 10 year average of 6.06 inches of rainfall reported only 1.90 inches of rain, Central Farm with a 10 year average of 3.03 inches reported 0.03 inches, and Corozal Agstat with 4.38 inches did not experience any rainfall in December, 1969.

At the Belize International Airport the temperature range during the year was 61°F to 96°F, but as usual during most of the year the heat and humidity were tempered by sea breezes as were, with small variations, the whole coastal areas. Inland the day temperatures during the dry season, with a few exceptions in the mountain Pineridge Area, tended to be high, up to 100°F, but dropped considerably at night. In general, during the dry season it was windy and during the rainy season calm. The daily mean evaporation for 1969 as read at Central Farm was approximately 0.33 inches.

III LIVESTOCK INDUSTRY

There are reasonable grounds for considering that 1969 may be looked back upon as marking a turning point in the development of the livestock industry.

As a result of measures taken at the end of the previous year the cattle population started to expand and progress was made in importing the economic basis by relaxation of retail price controls and by the establishment of livestock auction markets in the producing areas.

The resulting increase in financial return to the farmer together with the prospect of a guaranteed market in the shape of an abattoir and packing house nearing completion gave rise to a new mood of optimism with increased investment and expansion of production.

National Livestock Association

The Association struggled on through the year with a minimum of resources. If, however, it is to become truly viable and develop as a positive force in the livestock industry, it must secure adequate finance for its administration. To this end Government has been asked to impose a cess on slaughter of animals, payable to the Association.

Once on its financial feet the Association will take over operation of the livestock auction and, to that end, was securing permanent sites.

At Orange Walk a fifteen (15) acre site was presented to the Association by a prominent farmer to serve also as a Northern District Livestock Show Grounds.

In December a Cayo District Branch was formed which it is hoped will be followed in due course by branches in other districts.

National Livestock Conference

Two conferences, the first of their kind, were held during the year, in May and November. The first conference was on the theme 'Towards Greater Production' and included papers on 'Breeds and Breeding', Pig Production', 'The Role of the Small Producer in the Cattle Industry', 'Pasture Production', 'Supplementary Feeding', and 'Extension Services', each paper being followed by a discussion.

The second conference was on 'Pig and Poultry' and included papers on 'Market Prospects', 'Pig Management and Disease Control' and 'Feeds and Feeding'.

Apart from their educative value the conferences served to bring producers together and to encourage development of a sense of common interest and purpose.

Livestock Population

A census of the cattle population taken at the end of 1968 gave a total of 30,274 heads, an increase of 1,253 (4%) on the figure obtained at the beginning of 1968.

Distribution according to District and the size of the farm are given in Tables I and II while Table III gives the numbers of cattle in the several Mennonite communities.

Defining a small farm as one with not more than 100 head of cattle, it can be shown that 1,110 small farmers own 50% of the national herd while 37 medium and large farmers own the other half.

Growth is taking place mainly in the medium sized and large herds. While up to a point this favours economy of production, it would be unfortunate if the total number of cattle owners declined in a country where the scope for overall expension is so great.

The pig and poultry population are not known with any degree of exactitude but both are tending to increase. The rate of expansion and profitability of the pig and poultry industries will largely depend on the availability and cost of feed, the supply of which was already a matter of grave consideration.

With a marked increase in demand for mutton, and rising price, the decline of the sheep population was probably halted as farmers came to realize the potential value of their breeding flocks.

CATTLE POPULATION

TABLE I. DISTRIBUTION BY DISTRICTS

CATEGORY	BELIZE	CAYO	COROZAL	ORANGE WALK	STANN CREEK	TOLEDO	WHOLE COUNTRY
Bulls:							
- 1 yr.	429	1,091	17	660	67	86	2,350
1 - 2 yrs.	221	599	3	363	19	58	1,241
2 - 10 yrs.	123	614	8	197	31	66	1,039
over 10 yrs.	0	36	0	7	0	4	47
Total	600	2,300	28	1,253	117	212	4,710*
Cows/Heifers							
1 yr.	518	1,974	29	717	139	104	3,541
1 - 2 yrs.	500	3,117	14	868	101	155	4,765
2 - 10 yrs.	1,951	5,970	78	2,443	449	542	11,431
over 10 yrs.	63	447	0	67	9	50	661
Total	3,367*	11,508	119	4,155	698	829	20,676
Steers							
1 yr.	95	816	0	120	20	2	1,053
1 - 2 yrs.	154	1,297	3	15	18	20	1,507
2 - 10 yrs.	328	374	0	0	0	32	734
over 10 yrs.	0	18	0	0	0	9	27
Total	585*	2,508	3	135	58	65	3,323
GRAND TOTAL	5,540	16,321	150	5,636*	853	1,104	30,274*

* 'Adjusted'

CATTLE POPULATION

TABLE 2: DISTRIBUTION OF HERDS ACCORDING TO SIZE

NO OF CATTLE	NUMBER OF HERDS PER DISTRICT						
	BELIZE	CAYO	COROZAL	ORANGE WALK	STANN CREEK	TOLEDO	WHOLE COUNTRY
1 - 50	217	270*	13	442*	34	91	1,067
51-100	13	20	—	3	2	5	43
101-500	6	15	—	7	1	1	30
501-1000	—	5	—	—	—	—	5
over-1000	—	2	—	—	—	—	2
TOTAL NO OF HERDS	236	312	13	452	37	97	1,147

CATTLE POPULATION

TABLE 3: MENNONITE COLONIES

Mennonite Colony	No. of Farms with cattle	Total No. of cattle
Shipyard	246	1,444
Richmond Hill	11	65
Blue Creek	95	578
Spanish Lookout	98	1,681
Cristo Rey	17	238
TOTALS	467	4,006

Animal Husbandry

Whether considering cattle, pigs or poultry only a handful of farms in the country are managed according to reasonable standards of husbandry. In the majority of cases this is associated with lack of finance and know-how.

The pastures situation did not become critical as rainfall was higher than normal.

Use of molasses for supplementary feeding increased, and the National Livestock Association, with the help and cooperation of B.S.I. Ltd. under-took to provide a tank at Tower Hill Sugar Factory so that molasses can be available in quantities suitable for the smaller farmer.

Within the Department an Animal Husbandry Committee was appointed to review management and husbandry at Central Farm and to make recommendations. A first report dealing mainly with cattle was prepared and the recommendations implemented as circumstances permitted.

Central Farm continued to make available breeding stock, both cattle and pigs, of very high quality for which there is a growing demand.

Progress in livestock improvement as such continued to be slow perhaps inevitably so given the Department's limited resources and the existing circumstances of the livestock industry.

Livestock Marketing

An efficient marketing system is indispensable to rational Development of the livestock industry and an important feature of the year, under review has been the introduction of livestock auction sales at five centers in the main producing areas.

Following a tentative start and encouraged by the response, sales were organized during the second half of the year on a weekly basis at each center in rotation. Starting with cattle, the sales later included pigs and sheep.

The turn over is shown below:-

Market	No. of Sales	Cattle	Pig	Sheep	Value $
Bermudian Landing	6	231	34	16	26,102.13
Burrell Boom*	1	24	—	—	3,305.52
Calla Creek	6	130	43	—	21,973.95
Orange Walk	5	102	7	2	18,681.30
Sand Hill	5	179	15	—	23,137.67
Trapiche	11	313	82	2	47,508.50
Central Farm	1	17	—	—	2,835.01
Total	35	996	181	20	$143,544.08

* Special Disposal Sale of Open Range Cattle.

IV EXPORT CROPS

SUGARCANE:

The 1968/69 cane grinding season in the Corozal and Orange Walk Districts came to a close on 9th and 23rd June respectively. Grinding had lasted nearly 27 weeks at Libertad and 23 weeks at Tower Hill.

Essential statistics for the 1968/69 crop season are given in the following table

Particulars	Corozal District	O/Walk District	Totals
Tons cane delivered by Cane Farmers Association	210,718	80,010	290,728
Tons cane delivered by Belize Sugar Industry	81,555	156,437	237,992
Total Cane Delivered	292,273	236,447	528,720
Tons Sugar Manufactured	30,419	21,719	52,138
Tons cane/Tons Sugar-farmers farmers - B.S.I	9.93 10.22	9.93 11.45	- -
Molasses Production	9,829	8,857	18,686

Several factors adversely affected the 1968/69 crop resulting in a shortfall of 11,450 tons from last year's figure of 63,558 tons. included among the problems were froghopper infestation, cane fires, unfavourable weather conditions, and a decline in the use of fertilizers and herbicides. Nevertheless, the sugar industry injected some ten million dollars into the country's economy.

In December, the last payment for the 1968/69 crop was made. Final price paid for cane amounted to $12.66 per ton in the Corozal District and $11.95 per ton in the Orange Walk District.

Grinding season for the 1969/70 crop began at Libertad on December 8th, and at Tower Hill on December 13th. Production started slow but by month's end a total of 4,483 tons of sugar had been produced from 52,450 tons of cane.

Sugar Production 1964/65
1969/70

	Cane Milled (Tons)			Sugar Produced (tons)	Export Value $
	Cane Farmers	Estates	Total		
1963/64	130,000	80,362*	210,362	27,840	5,413,472
65	189,933	82,396	272,319	33,591	4,831,037
66	200,000	125,786*	325,786	35,388	6,492,014
67	282,640	128,712	411,353	43,453	8,018,850
68	290,727	227,993	528,720	52,138	9,580,000
69	400,000	242,515*	642,515	63,588	9,941,283
1969/70	394,194	281,981	676,175	66,785	N.A.

* Estimated

CITRUS

Crop Statistics 1965/70

Year	Oranges (90 lb boxes)	Grapefruit (Sold boxes)
1965/66	952,064	247,627
1966/67	699,545	235,904
1967/68	733,838	233,433
1968/69	849,166	281,310 - Down 34.2%
1969/70	558,452	258,749 - Down 8.7%

The following figures represent exports by the two processors operating in the country:

EXPORT OF CITRUS PRODUCTS

Product	Unit	1968/69 Crop	1969/70 Crop
1. Orange Juice Single Strength	A/2 - 24	107,858	72,467
	404 - 12	50,404	10,000
	A/10 - 6	40,827	24,273
2. Orange Juice			
Conc. 65°Brix	A/10 - 6	24,408	12,826
60° "	A/10 - 6	1,286	25,354
60° "	Brls. of 43 gals.	2,292	1,353
65°Frozen	Drums of 53 U.S. Gals	3,449	—
3. Grapefruit Juice Single Strength	A/2 - 24	9,167	5,999
	A/10 - 6	38,834	26,260
4. Grapefruit Juice Concentrated	4/1 A/10 - 6	243	1,325
	4/1 Brls. of 43 gals.	81	148
5. Grapefruit Sections	A/2 - 24	268,707	232,644
6. Frozen Orange Concentrate	Pails	24,212	8,267
	Drums	NIL	1,233
7. Grapefruit - Oil	per lb.	980	916
8. Orange - Oil pressed	per lb.	129,109	100,565

The total crop purchased by the two factories was 1,130,476 boxes, one of the Largest ever, save for the 1965/66 crop of 1,199,691 boxes. The last year's crop was 967,271 according to the Association's most recent figure.

Comparatively low prices, though better than the previous year, particularly for orange concentrate, continued to preclude delivery of fruit from the more out-lying producers in the Cayo District - thus the full potential was not realized. Small producers continued to find it difficult to adequately maintain and fertilize their groves out of the low net returns they have been obtaining. Mexican Fruit fly of grapefruits, premature fruit drop of oranges and generally poor husbandry inhibit the further full realization of potential. The United Kingdom continued to be the chief export market for B.H. citurs produces; other countries to which exports are made are Canada, U.S.A., Fiji and France.

Small but growing fresh fruit export market exists with Mexico, most of the fruit coming from areas too distant from the two factories. Shipments are made up of oranges mainly with smaller quantities of grapefruit and Tangerines.

Very little expansion took place during the year. Value of citrus exports for 1969 was (B.H.) $7,683,000 representing an increase of 5%.

The following figures, supplied by the Citrus Growers Association, reflect the growth of the citrus industry over the years since its beginning.

Year	Acreages in		Total
	Grapefruit	Oranges	
1913		-----	15 acres
1945	850	-----	850 "
1955	1,078	3,866	4,944 "
1959	1,189	4,146	5,375 "
1964	2,050	6,114	8,164 "
1969	2,441	6,630	9,071 "

BANANAS :

The banana industry experienced a serious setback when one Company, Caribbean Empire, Co. made shipments up to February and thereafter abandoned the plantations. The other Company, Green and Atkins, made no shipment after August due to extensive damage caused by Hurricane Francelia; thus the two small local producers who were engaged in the export trade have had to find alternative outlets on the local market with some fruit going across the border to Mexico. Total exports amounted to 62,842 boxes.

Several factors account for the decline in production the chief of which was undercapitalization of the two largest exporters. This lead to insufficient fertilization and aerial spraying which in turn resulted in a high percentage of rejects due to 'Sigatoka' and poor husbandry practices in general.

BANANA EXPORT DATA

Boxes of 40 lbs. net each

1964 - 11,337 boxes

1965 - 20,530 "

1966 - 169,249 "

1967 - 152,231 "

1968 - 205,000 "

1969 - 62,842 "

VEGETABLES:

In 1969 Belize Offshore Growers Limited prepared for cultivation 1,700 acres of land up to June. 1,316,936 lbs. of tomatoes valued at $20,098 and 6,614,768 lbs. of cucumbers valued at $161,618 had been exported.

By the end of the year another company, Savannah Products, Ltd., had commenced production. Exports for the 1969/70 crop, by December, were 3,267,100 lbs. of cucumbers and 416,400 lbs. of tomatoes.

HONEY AND BEEKEEPING:

Honey production totalled only 112,964 lbs. of which 109,760 lbs., or 49 long tons, were exported. Production in 1967 and 1968 were 425,078 lbs. and 468,158 lbs. respectively indicating a marked decline in production during 1969. Domestic consumption totalled only 3,204 lbs. compared to 70,438 lbs. during 1968 and 76,409 lbs. during 1967.

Ninety six pounds sterling per long ton were paid by Kimpton Brothers of England f.o.b. Belize City port for all exported honey. On the other hand honey retailed nationally fetched $137.50 per drum weighing 660 lbs. nett.

Honey exported were of the following classifications:

White	10	drums	Moisture content	18.0%
Golden	100	drums	" "	17.5%
Light Amber	54	drums	" "	16.5%
	164	"		

There was an average production of approximately 30 lbs. honey per hive and the number of full fledged colonies in all the Districts during honey flow was 2,309 hives as compared to 4,779 in 1968 and 4,922 in 1967.

During the year some 1,624 lbs. was produced. The greater part of this was manufactured into wax foundation by Norwalk Federation of Honey Producers Ltd and sold at 18 to 20 cents per sheet, 4,000 sheets being sold. The balance of unprocessed wax was used to lacquer drums for packing honey for transportation to the Honey Plant.

The position at the end of 1969 was as follows:-

District	Apiaries	Hives	Beekeepers	Production lbs 1968	Production lbs 1969
Corozal	37	1,170	30	227,638	58,640
O/Walk	40	1,213	23	222,860	46,200
Cayo	5	72	4	9,000	3,300
S/Creek	10	127	6	1,320	204
Toledo	5	50	4	3,300	3,300
Caye Caulker	1	2	1	80	Nil
Belize	2	175	1	3,960	1,320
TOTAL	100	2,809	70	468,158	112,964

Several factors have influenced honey production. The bee-keepers express the view that since the sugar company began spraying their cane fields for frog-hopper control in the latter part of 1968 the insecticides have killed some hives. Others feel that hives that have been weakened by insecticide sprays are subsequently abandoned by bee-keepers rather than attempt to restrengthen them to meet the next honey flow.

Weather conditions were also against high production,

The usual dry weather which coincides with best honey flow did not occur in the Northern Districts during 1969. During 1968, 48.46 inches of rain fell in 71 days in the Corozal District whilst in 1969, 64.16 inches fell in 101 days.

CACAO

During 1969 Caribbean Investments Ltd. and Roaring River Estates, both located on the Hummingbird Highway maintained their groves. The sole exporter was Caribbean Investment Ltd. who also bought beans from small producers in the Toledo District. Approximately 15 tons of fermented and dried beans were exported during May and June.

V. FOOD CROPS

Conditions for land clearing and burning, planting and harvesting of major food crops was not favourable with resulting short falls in the production of corn, beans and vegetables. In the north of the country the Rio Hondo and New River remained at flood level for almost the whole of October. Similarly the Sibun and North Stann Creek Rivers flooded off and on. During July, the Monkey River was in full flood causing much damage to crops in that area.

On September 3rd. Hurricane Francelia struck the southern portion of the country causing major damage to crops.

Most of the food crops were produced as usual by milperos whose methods of cultivation is still shifting and slashing burning. Only in the production of rice and to some extent corn among the Mennonites is this method undergoing significant change.

The Marketing Board continues to offer an assured market at guaranteed prices for certain crops and effective August 1, 1969 the Board approved and increase of $1.00 per 100 lbs. on the purchase price of paddy with an additional bonus of $1.00 per 100 lbs. for paddy delivered to the Board ready for milling. A price of the crops so affected over the past three years is given below. All prices are over 100 lbs.

Year	Mixed Yellow Corn	Yellow Corn	Paddy	R.K. Beans	Baby Red Beans	Black Eye Beans	Pimato	Annato
1967/68	3.50	4.00	6.50	14.00	6.00	8.00	40.00	10.00
1968/69	3.50	4.00	6.50	14.00	6.00	8.00	40.00	10.00
1969/70	3.50	4.00	7.50	14.00	6.00	8.00	40.00	10.00

Beans - Red Kidney

Year	Acreage	Est. Productions (000 lbs.)	Marketing Board Purchases (000 lbs.)
1962/63	1,587	1,269	747
1963/64	1,810	905	483
1964/65	1,884	1,507	584
1965/66	3,484	2,187	592
1966/67	2,219	1,667	409
1967/68	4,013	2,809	545
1968/69	4,748	3,419	215
1969/70	7,534	6,000	598

The crop planted traditionally in late 1968 and into the beginning of 1969 showed a marked increase in acreage over the two previous years. In the Toledo District planting was later than usual due to adverse weather conditions.

The local Mennonite communities continued to show an interest in this crop. By the end of January in Orange Walk they had already harvested an early crop which went immediately on the local market at .27 and .28 cents per pound. The main crop was harvested during March. The Mennonites as usual stored most of their main crop with the expectation of higher prices as the past harvest glut in used up.

Certified seeds for planting was again imported from the U.S. but small farmers generally shy off due to the high cost although it is becoming more generally realized that imported seeds are superior if properly fertilized and cared for.

MAIZE:

Year	Acreage	Est. Production (000 lbs.)	Marketing Board Purchases (000 lbs.)
1963	13,331	6,665	228
1964	11,383	9,107	776
1965	13,390	12,051	256
1966	15,506	6,742	36
1967	14,890	14,800	81
1968	16,361	15,473	511
1969	17,550	17,000	119

Seeds of various types are now in common use including Mexican synthetic VS550 A, which was introduced 3 years ago. The Jamaican Hybrid Pioneer 306 was also used for the first time with good results. During February maize was available in all districts by April early plantings "Mata Hambre," especially in the south was being harvested.

Rains during March held up land clearing somewhat. But by end of July some 17,550 acres had been planted to the main crop.

As reported earlier there was flooding especially in the south during July, and Hurricane Francellia caused more flooding in September. Nevertheless the production was estimated to be 17,000,000 pounds.

Acreages planted continued to rise due in part to renewed interest in pigs and poultry rearing especially in the Northern sugar cane Districts. So far only a few farmers besides the Mennonites have grown this crop on large tracts of land using machinery. At present rate of development of the pig and poultry industries exports of corn are not foreseen in the near future even in the light of expanding production. Indeed by December a shortage of corn was evident with prices responding upward.

RICE:

Year	Acreage	Est. Production Paddy (000 lbs.)	Marketing Board Purchases (000 lbs.)
1963/64	3,131	4,695	2,718
1964/65	3,918	5,877	4,508
1965/66	6,381	7,657	5,230
1966/67	4,578	3,130	2,648
1967/68	5,130	8,146	5,958
1968/69	4,421		
1969/70			

The rice crop was not as good as expected due to adverse weather conditions especially in the southern part of the country. On 4,421 acres an estimated production of over 5,000,000 lbs. was harvested. Marketing Board purchases at the end of December 1969 was 4,449,357 pounds.

During the year private companies were engaged in the production of rice on a mechanized basis. Over 270 acres were planted for the main crop by Big Falls Ranch Ltd. and further planting of 600 acres of irrigated rice were in train. This company has set up a mill and will in future process and market all the paddy it produces at Big Falls in the Belize District. Small farmers paddy will also be bought if it is of acceptable type and quality.

In the Toledo District the traditional rice growing area, where some 2,142 acres of rice were planted, the Marketing Board had purchased 3,563,572 pounds of paddy by years end. The following table shows production based on Marketing Board purchases in the Toledo District for 1969.

Year	Est. Acreage	Marketing Board Purchases (lbs.)
1964	2,290	3,003,567
1965	2,432	3,624,421
1966	1,638	1,436,314
1967	1,462	2,430,903
1968	2,381	3,168,497
1969	2,142	3,563,572

During the previous year (1968) the Agricultural Department initiated two pilot schemes for mechanised rice production with funds provided by the C. D. and W. grant. These continue to operate in the Mafredi and San Pedro Columbia areas of Toledo with acreages now totalling 200 and 100 acres respectively.

All operations except weed killing is carried out mechanically and the schemes are proving very successful.

Which interest has been aroused among the individual farmers and two rice growing cooperatives in the District. Demands are being made for land clearing equipment and also farmers are asking for assurance that combine harvesting services will be available to them.

Rice growing in the District got another shot in the arm when the Marketing Board announced new prices for paddy. Farmers were paid according to moisture content and presence of foreign material. The lowest price paid was $4.45 per 100 lbs. (of 15% foreign material and 23.1 to 25% moisture), and the highest was $7.20 per hundred lbs. (moisture 15% or below and foreign material not exceeding 3%). An additional premium of $1.00 per 100 lbs. was paid for paddy with moisture below 14% and with good milling returns of not less than 60%. Farmers are expected to react favourably to these prices during 1970.

The following varieties were planted in Toledo in order of acreages. Texas, Patna, Country Patna, Belle Patna, Nile No. 3, Blue Bonnett, Nile No. 1, Nile No. 48, B.H. Creole, Nile No. 47, Fortuna, Dima and Barley. The Department of Agriculture introduced the Nile varieties from El Salvador to the Toledo District.

Vegetables: (not including cucumbers and tomatoes)

The usual situation has not changed much, the country not being climatically suited to all year production of temperate vegetable crops. Furthermore very little irrigation is available and rain fed winter season over production of most vegetables is the general rule. During the off-season imports from the United States by air and sea and from Mexico and Guatemala by road and sea are the main source of supply. The problem is not expected to disappear as it is being aggravated by a growing tourist industry consisting of American, Canadian and Mexican visitors in the main who demand fresh vegetables all year round.

Plantains

Supplies were generally sufficient for the local market up to the time of Hurricane Francellia which devastated most of the plantains in the southern areas. The attempt to export plantains to the U. S. was stifled before it commenced, when the entrepreneur who had planted 65 acres in the Monkey River area met with accidental death and of course the Banana boats stopped calling in the latter part of the year.

Other food and fruit crops

Supplies of cassava flour, sweet potatoes and other edible roots and tuber crops were generally adequate being supplemented with imported irish potatoes and onions. An attempt was made to grow irish potatoes and onions at Central Farm and Yo Creek under the import substitution programme but this was somewhat experimental being on a small field scale. Further trials will be carried out during 1970.

Near San Felipe in the Orange Walk District a foreign concern obtained several thousand acres of land for the purpose of planting Mangoes and other tree crops for eventual export to the U.S.

In the South near Big Creek, Dr. McCleary's 1000 Mango Farm was beginning to show promise with the Tom Atkins variety doing best on the pine-ridge soils.

VI - Agricultural Development and Extension Work

General

There was no overall improvement in Departmental staffing position. The posts of Agricultural Chemist and Entomologist remained vacant during the year. One additional post of Principal Agricultural Officer was established and both posts filled temporarily from within the service when the expatriate holded left the country after his contract expired at mid-year.

All six districts were headed by assistant Agricultural Officers at years end.

General elections held late in the year resulted in the Agricultural Department being taken out of the old Ministry of Natural Resources and Trade and placed in the new Ministry of Agriculture, Lands and Cooperatives under a new Minister. At the same time the Fisheries Unit was retained in the Ministry of Trade and Industry.

Thus under the new Ministerial set-up the Ministry of Agriculture assumed responsibility for domestic marketing of Agricultural produce whilst the Ministry of Trade and Industry was made responsible for external marketing arrangements.

Central Farm continues to do good work with the available technical staff even though this has had a very limiting effect, on the quantity and quality of work.

The team which started the Belize River Valley Survey during 1968 continued to collect data at the various rainfall stations, general weather stations, and river discharge stations.

Some 34 stations of the various classes mentioned above were in use, a number of which are privately manned.

Agricultural Education

(a) Agricultural Education

Nine courses were held at the Central Farm school for farmers for a total of 87 days duration and 127 persons received training. See Appendix.

Two one day short courses were held in the Corozal and Orange Walk Districts in pig production. A total of 60 farmers attended these courses.

A one day short course in poultry production held in Corozal District was attended by 24 farmers. Instruction was by the Veterinary Officer, Livestock Officer and Farm Planning Officer in addition to District Extension Staff.

Fifty - eight farmers from Corozal and Orange Walk Toured Central Farm and neighbouring farms for two days in September and December.

Two field days were arranged by the officer in charge of Cayo District. Twenty four farmers participated.

A three - week course was conducted at the Central Farm School by the Department of Education. A total of 21 teachers attended and Central Farm staff gave lectures in Agricultural subjects. Four visits were made to Lyham Agricultural College by staff members to give lectures.

The Agricultural Officer, Education, attended one meeting of the National Council for Education.

(b) Publications

During the year the following publications were put out and circulated among farmers:-

Bulletin No. 3	Poultry Diseases
Bulletin No. 4	Growing R.K. Beans in Belize
Bulletin No. 5	Planting Forage Sorghum in Belize
Leaflet No. 2	Collecting and Storing Grass Seeds
Carta No. 1	Diez Sugerencias para una mayor produccion de Huevos.

(c) Radio

The weekly programme "Farming For Progress" was broadcast 2nd Sundays at 2:15 p.m. each broadcast running for 30 to 40 minutes.

The following themes were developed:-

January	-	Pig Management
February	-	Pasture Management
May	-	Maize Cultivation
October	-	R.K. Beans Cultivation, Storage of Grains
November	-	Pasture Establishment
December	-	Rations for Pigs

(d) Visual Aids

The 16 m.m. Movie projector and Kodak Slide Projectors was used extensively on all courses, at the San Ignacio Farmers Forum and in the Districts. Films were borrowed from the U.S. Consulate and the British Council in Belize City.

(e) Agricultural Shows:-

The National Agricultural Show was held at the National Show Grounds located at the New Capital Site. One other minor show was held in the Orange Walk District.

(f) Demonstrations:

In collaboration with CARE and farmers a number of corn demonstration plots were laid out in each district. The demonstrations embodied a package of improved practices, including use of an improved hybrid seed, proper spacing and fertilizing. Yields were much larger than corn grown under the milpa system.

VII RESEARCH AND INVESTIGATIONS

Horticulture: Tree crops

The University of the West Indies Citrus Research Unit located in the Stann Creek Valley continued to investigate pests and diseases of citrus on behalf of the Citrus Growers Association. The main problems investigated were premature fruit drop; Stink Bugs and Mexican Fruit Fly. No other tree fruit investigation was in progress.

Vegetables

Vegetables trials were carried out at San Roman, Yo Creek, Toledo Agstat and Central Farm.

Plants cultivated were:-

Tomato: Marion, Hybrid N-9, Indian River, Manapel, Homestead 24, Jefferson, Kopish, Manalucie, Floredel, Hybrid 69, Hybrid 11, Hybrid 65, Hybrid 5, Certified Rutgers, Jubilee.

Lettuce: Reuters Florida, New York, Avenue, Waya Head, Great Lakes, Iceberg.

Cabbage: Flat Dutch, Marion Market, Copenhagen Market, Early Jersey.

Cauliflower: Early Snowball, Paurea, Suttons Tropical.

Sweet Pepper: Cuban, Yolo Wonder, World Beater.

Broccoli: De Cicco, Waltham 29.

Carrots: Danvers Half Long, Model or Chantenay

Radish: Crimson Giant.

Cucumber: Marketer, Poloris, Palmetto, Ashley.

Brussels Sprout: Jade Cross F1 Hybrid.

Onion: Yellow Bermuda

Mustard: Chinese Broad Leaf, Tendergreen.

Swiss Chard: Lucullus, Rhubard.

Chinese Cabbage: Michili.

Yams:-

Two varieties of yams were planted. The Negro Yam gave a yield of 15 tons per acre and the Barbados Yam 16 tons per acre.

Sweet Potatoes:-

Accurate yields cannot be given because of heavy losses from rodents. Varieties planted were C - 19, Wild Horse, White Star, Black Rock, Ten Weeks, Flagell, F - 2 and C - 9.

SECTION I - CROPS

Field Crops : CORN (ZEA MAYS)

This year approximately 200 acres of corn were planted. One hundred as an Import substitution project, and the other hundred acres for use by the Livestock Section as feed for pigs and cattle.

Due to severe flooding which occurred at the time of silking approximately 90 acres of the corn were completely destroyed. Of the remaining 110 acres, 50% of the plants were lodged due to a combination of high moisture and strong winds.

Every effort was made to harvest the lodged plants, but this was found to be uneconomical and time consuming. As a result the majority of this corn was not harvested and eventually rot in the field becouse of high moisture. All of the standing corn plants were harvested mechanically. This year for the first time a corn combine was used to harvest corn at Central Farm. During the first few days we encountered quite a bit of difficulty before harvesting could be achieved properly.

On the second week of harvesting a J.F. dealer came to Central Farm to inspect and adjust the new combine. After a few minor adjustments, the combine proved to be more efficient and economical than the one row harvester.

The one row harvester worked quite well for the first week of harvesting. After this, however, it was continuously in the garage for repairs. It is anticipated that new parts will be obtained for repairing before commencement of next years corn harvest.

Two corn varieties were planted this year, VS550A - 25 acres, and x306 - 75 acres. VS550A is a synthetic corn variety obtained from Mexico approximately four years ago. x306 is a hybrid corn from Pioneer in Jamaica. This is the first year it is being grown in this country.

An application of 150 lbs per acre of 18:46:0 fertilizer was applied at the time of planting to both varieties. When the plants were approximately 18 inches high or four weeks after germination, an application or Urea was made at the rate of 100 lbs per acre. Two cultivations were deemed necessary in order to control weeds between the rows. Because of army worm (Spodoptera giperda) infestation two spraying with DDT were required in order to obtain reasonable control. During the application of DDT, 24-D was also applied in order to control broadleaf weeds. This gave a complete control of broadleaf weeds and vines which are usually hazardous at time of harvesting.

An average yield of 4,500 lbs grain per acre was obtained from the z306 variety, and 2000 lbs grain per acre was obtained from the VS550A variety. Of the 75 acres of x306 planted only 5 acres could be partially harvested. And of the 125 acres VS550A planted only 105 acres could be partially harvested.

Experiments:

a. Old Trials

Six experiments were harvested this year. These consisted of a Rice (Orvza sativa) Variety Trial, Irish Potato (Solanum tuberosum) Variety Trial, a K. K.Beans (Phaseolus vulgaris) Weed Control Trial, a Soybean (Glycine Max) variety and Time of planting trial. There other trials, corn variety, corn fertilizer and corn chemical weed control trial scheduled for harvesting were discarded because of flooding caused by Francellia hurricane in September.

b. New Trials

Two experiments were laid down this year, a Dry Beans (Phaseolus vulgris) Variety Trial and R.K. Beans (Phaseolus vulgris) fertilizer trial. The Dry Beans (Phaseolus vulgris) will be harvested early next year. The R.K. Beans (Phaseolus vulgris) fertilizer was abandoned because of extreme drought and fungi attack.

Rice (Oryza sativa) Variety Trial Under Wetland (Irrigated)

Conditions.

Summary Rice

Twenty-one rice varieties were included in a trial at Central Farm where plots were irrigated and the growth performance of the varieties compared. Water supply was adequate during the period of growth and no problem was encountered in draining the area at time of ripening.

This trial was replicated from one laid down at mile 20 on the Western Highway; but the yield comparisons were quite different. Highest average yields were obtained from the variety B5580 with 6,600 lbs clean paddy/acre and IR-5 with 6,300 lbs clean paddy/acre. Other varieties giving favourable yield were IR 160 - 27 - 4 - 1, IR -154, and IR - 8 with 5,300 lbs 5,100 lbs clean paday per acre respectively.

Infection by the virus disease which causes Hoja Blanca was noted in the varieties Milfor 6, IR - 5, and B581A6 - 545 the latter of which seemed to be most severely affected. Brown leaf spot occasioned by the fungus Helminthosporium Oryzae was observed in varities Nilo 47, Nilo 48, Milfor 6, B 572A - 3, IR - 8 and IR - 5; no control was, however, practiced.

Introduction and Objectives

During the course of the years many trials have been conducted in testing the yield capacity of different rice varieties. These trials have always taken into consideration the disease resistance of the particular varities of rice under experimentation. This point is important and cannot be indifferently separated from the characteristic of yield capacity of any variety. That is to say, although a variety may yield well under experimental conditions in small plots, the likelihood of it doing well in comercial plantings for any length of time, if it is susceptible to any disease, will be considerable reduced.

The objective of this trial was to compare the growth performance and yield of these rice varieties and determine the variety with the best quality and highest yield.

Methods and Materials

i) Site: Horticultural Section, Central Farm
ii) Soil type;- Chenchem black clay
iii) Varieties:-

IR-5	IR-52-18-2	B 581 A6
IR-154	IR-76-45-1	IR-127-80-1-10
IR-8	IR-154-61-1-1-	Nilo-3
IR-4-93-2	B-572A-3	Nilo)47
IR-400-5-12-10-2	B-573A-3-47-15-1-12	Nilo-48
IR-160-27-41-1	B5580	C 4 - 63
IR-532-1-218	B 581 A6-545	Milfor - 6

Design of Experiment

The disign was that of a completely randomised block. No replication of blocks was possible, however, because of the shortage of seeds. Even as it was, one variety, IR 532-1-218, had to be planted in a slightly smaller area because of lack of sufficient seeds.

Plot Size

Plots measured 1/265 acre, rows being spaced one foot apart. The size of the entire block was 2/13 acre.

Pre-Planting Cultivation

Before laying down the experimental design the area was ploughed; levees were also shaped up to approximately 2.5' high.

Planting

The varieties were planted in rows one foot apart in a type of drill-method whereby a density equivalent to approximately 40 lb of seed per acre was attained. Date of planting was 1st October 1968.

A Complete fertilizer combination was given to all varieties, applied in the form of urea, triple superphosphate (T.S.P.) and muriate of potash (KCL). Urea and T.S.P. were applied at equivalent rates of 165 lb per acre and KCL at 115 lbs per acre. Urea was again applied at 25 lb/acre equivalent about 40 days after planting.

Growth Performance

The germination percentage of the varieties varied from as low as 5 % to as high as 100 %. Seven of these varieties had a germination percentage less than fifty, varing between five and forty-five percent. Germination of the other varieties ranged from fifty to one hundred percent. Table I shows the germination performance of the different varieties.

TABLE I

Germination Performance (% age) of Rice Varieties

Range 5% - 45 % Variety	Actual % age	Range 50% - 95% Variety	Actual % age	100%
IR-532-1	5	B-572A-3	50	IR-5
B-581A6-545	10	Nilo 47	50	IR-154
C-4-63	15	IR4-93-2	50	IR-127-80-1-0
B-5580	20	B-581A6	75	IR-400-5-12-10-2
Nilo-3	40	Milfor 6	80	
IR 52-18-2	40	Nilo 48	85	
IR 154-61-1-1	45	B 572A3-47-15-1	85	
		IR 76-45-1	85	
		IR 160-27-4-1	90	
		IR 8	95	

Since the irrigation system was efficent, the weather condition did not much influence the trial during the early stage of growth. All plots always received adequate water when needed and were therefore able to maintain vigour and healthy growth. As a result also the trial was greatly assisted in its later maturing stage. When the grains started to ripen, all plots were drained and left to dry; as the weather was hot and dry at time of reaping all varieties were harvested in a reasonable dry state.

Insect Infestation

The most noteworthy insects that attacked plants were the white moth-stem-borer (Rupella albinella) and leaf hoppers (Sagatodes spp.) The area was heavily infested with the former, the effective control of which was achieved by spraying with Sevin at 6 ozs. per 3 gals. water and with Metsystock at 10 c.c. per 3 gal. water. Dusting with Malathion at an equivalent rate of two pounds (2 lb.) per acre gave control of the leafhopper insect.

Diseases

The virus disease, Hoja Blanca, was observed in the varieties Milfor 6, IR-5, and B581 A6-545, though it appeared to be most severe in the latter variety; no control measures were taken.

Harvesting

Harvesting of the trial commenced on the 14th February. Among the outstanding varieties in growth performance were the I R-5, IR-154, C4-63, B5580, IR160-27-4-1, and IR-8. Despite the fact that two of these varieties had a low germination percentage, their tillering and yield were generally high.

The other varieties that gave satisfactory growth and good yield were IR 52-18-2, IR 400-5-12-10-2, IR 532-1-218, C4-63, IR 127-80-1-10, Milfor 6, IR 76-54-1, and IR 4-93-2. The other varieties that had sparse population and low yield were IR 154-61-1-1, Nilo 47, Nilo 48, Nilo 3, B572 A-3, B 561 A-3, B 581 A-6, B 572- A3-47-15-1-12. The variety B 581 A6-545 gave the poorest growth and lowest yield. Reference to table II gives an indication of yield distribution among the varieties.

TABLE II

Yield of Clean Paddy in lb/acre

Above 5,000		5,000 - 3,000		3,000 - 1,000	
Variety	Yield	Variety	Yield	Variety	
B5580	6,640	C4-63	4,955	B 581 A6	2,59
IR-5	6,278	IR127-80-1-10	4,627	IR154-61-1-1	2,591
IR160-27-4-1	5,306	IR400-5-12-10-2	3,812	B572 A-3	2,558
IR-154	5,136	IR4-93-2	3,651	B572A3-47-15-1	1,733
IR-8	5,136	IR532-1-218	4,208	Nilo 48	2,898
		IR52-18-2	3,620	Nilo 47	1,650
		Milfor 6	3,444	B581 A6-545	1,536
		IR76-45-1	3,321		
		Nilo 3	3,176		

Correlations were run to determine whether there was any influence of tiller density per stool, number of panicles, number of peducles, or germination percentage on yield of clean paddy. The highest correlation coefficient was found with the relationship between germination percentage and yield but was not significant even at the 0.05 level.

Conclusion

The varieties giving by far the highest yields in the trial were B5580 with 6,640 lbs. per acre and IR-5 with 6,278 lbs. per acre. This trial had no replicates because of the unavailability of seeds so the authenticity of results cannot be vouched for. Forthermore, because of the extraneous factors introduced into the trial sited at Mile 20 along the Western Highway there can be little correlation drawn from variety performances at the two sites.

It is intended to plant an area of rice at Central Farm this year to increase the stock of seed from six or eight of the more promising rice varieties, these include B5580, IR-5, IR160-27-4-1, IR-8, C4-63 and posibly two more yet to be chosen. This seed multiplication programme is being conducted with the intention of laying down further trials during the latter part of the year.

Ac/839/2 - IRish Potato (Solanum tuberosum) Variety Trial

Summary

Six varieties of Irish patatoes Solanum tuberosum were yield tested at Central Farm, Due to shortage of seed materials no replication was possible.

Norchip variety yielded the highest 9,316 lbs. per acre whereas Norchip yielded the highest it also had the highest percentage of rotten tubers. Knnebed variety had the lowest percentage of rotten tubers and in effect gave the highest yield of good tubers.

Introduction and Objectives

During the past year there has been an increased interest in potato production in Belize, British Honduras. Annual importation of Irish potatoes is quite high and with keeping with government's policy, a preliminary trial was laid down at Central Farm.

The objective of this trial was to determine whether or not potatoes could be grown in this country, economically, of good quality, and high yields comparable to tother sub-tropical countries.

Methods and Materials

i) Site - Riverside Area, Central Farm
ii) Soil type- Cuxu brown clay loam
iii) Varieties - Benje Norchif
Kennebec - Norchip

Red Lasoda—Norgoal Russet

Design of Experiments : The disign was that of a completely randomized block. No replication was possible, however, because of the shortage of seed material. All varieties which constituted one row contained ten pounds of seed material except red Lasoda which consisted of fifty pounds of seed material planted in three rows.

Plot size: - Because of the difference in sizes of the seeds the plot size of each variety was different. The plot sizes are as follows:-

Norchip -66 feet x4 feet
Norgold Russet - 57 x 4 ft. Norfhief 59 ft x 4ft
Kennebec - 72' x 4 ft. Benje - 109' nx 4'
Red Lasoda 93 x 12 ft.

Preplanting Cultivation

The area was plowed, horrowed and retovated to give a medium fine tilth. Just prior to planting, the site was ridged, ridges were spaced four feet apart.

Planting

The varieties were planted on ridges four fee' apart on the 6th January 1969. Each potato tuber was cut into pieces each with approximately 2 to 3 "eyes". These pieces were planted approximately 18 inches apart.

The plots were fertilized with 12:24:12: fertilizer at the rate of 500 lbs. per acre. The fertilizer was placed in bands 4 - 6 inches away from the seed piece.

Result and Discussion This trial was harvested on 31st March 1969. Table shows the result of the six potato varieties yield tested at the Riverside, Central Farm.

TABLE iii

Variety	Yields in lbs/acre	Percentage Rotten Tuber
Norchip	9,316	41.9
Benje	7,900	14.2
Norgold Russet	7,816	8.6
Kennebec	7,605	3.5
Red Lasoda	6,931	22.1
Norchif	4,777	13.1

From this table it can be seen that Norchip outyield all the other varieties considerably. However, this table also shows that thi variety had the highest percentage of rotten tubers.

In respect to the physical characteristics of the tubers, Norchip and Norchif were of medium size (E type potatoes) whereas Red Lasoda produced the largest tubers (jumbo size) Benje produced the largest number of tubers per plant.

Because of dorought conditions it was necessary to flood irrigate the plots in order to maintain proper moisture condition. The major pests which affected this crop were Diabrotica, Cutworms and early blight. Diabortica was controlled with sevin at the rate of 4 lbs/acre to the soil. Early blight was controlled by spraying Parzate and Pernox at the rate of 1 and ½ lbs. per acre respectively.

Conclusion

Because this was a preliminary trial the conclusion made can only be accepted as such. More work is definately required to substantiate any remarks made. It would appear that for this country Kennebec and Red Lasoda varieties are quite adapted. The yields obtained however, appear to be quite low and as such would make this crop very uneconomical to grow in this country. Better water control is needed on prior crops before statements on feasability can be accertained.

R.K. Beans Chemical Weed Control Trial

Introduction

On the 10th January 1969 a chemical Weed control trial was laid down at the Riverside Area, Central Farm. The objective of this trial was to determine the most effective and economiaal chemical in controlling weeds in R.K. Beans.

Experimental Design:

The design used was a completely randomized Block with two replications.

Site : Riverside Area, Central Farm.
Soil type : Red Bank silty clay loam.

Treatments

(ii) Herbicides

Three preemergence herbicides at three levels and their combinations in groups of two were applied to the respective plots.

The names of the herbicides were Atrazine at levels of 2,3, and 4 lbs per acre, Karmex at levels 1,2, and 3 lbs per acre Lorox at 3, 4, and 5 lbs per acre and combination of Atrozine at 1:1, 2:1 and 1:2 ratios at rates of 2,3 and 3 lbs per acre equivalentrespectively.

Land Preparation

The sight was ploughed to a depth of six to eight inches and then harrowed twice to give a medium tilth.

Planting

Planting was done by hand in rows two feet apart and six inches between plants.

Weed Control

At the time of planting the pre-emergent herbicides were applied to the appropriate plots.

Results and Discussion

The percentage germination was quite adequate in all plots. At germination, however, young seedlings suffered chemical burn. All of the chemicals and their combinations were quite effective in controlling weeds. However some of the chemicals were phytoxic to the bean plants.

TABLE IV
Response of Chemicals To Weeds in R.K. Bean
No Phytotoxicity to R.K. Beans

Chemicals	Panicum sp.	Enchusiocola sp	Momordia	Amar-anthuis	Euphorbia
Lorox-L1	75%	75%	75%	75%	90%
L2	90	100	100	100	90
Karmex-K1	100	100	100	60	100
K2	100	100	100	100	100
LK 1	100	100	100	85	100
	15 Toxicity to Bean Plant control up to flowery				
L3	95	100	100	95	100
LK2	80	100	100	80	100
LK3	80	100	100	80	100
Ak1	95	95	95	95	95
K3	85	85	85	85	85

TABLE V

Chemicals	Pancum	Enchiochloa	Memordia	Amaranthus	Euphorbia
AK3	98	98	98	98	98
ALK2	97	97	97	97	97
All	95	95	95	95	95
30% of Toxicity to Crop Control up to Flowering					
A1	95	95	95	95	95
A2	97	97	97	97	97
A3	97	96	97	97	97
Ak2	95	95	95	95	95

From the results obtained it would appear that four lbs. per acre Lorox, or 1 lb./acre of Karmex is the most effective chemical in controlling weeds in beans field and also not toxic to the bean crop.

In respect to economic, Karmex is less expensive and therefor would be the cheaper of the two herbicides. However care should be exercised when using this chemical, because (i) it is very toxic to bea plants at higher combinations (ii) this is the first experiment done at Central Farm in respect to chemical weed control in Beans and as such more information is needed before it can be definately stated that the above mentioned chemical is superior to lorox or any other herbicide.

Soybean (Glycine Max) Variety & Time of Planting Trial

Introduction

Soybean is considered a very valuable crop for livestock. Because of its relative newness in this country, it was decided that the best variety and the exact time of planting should be ascertained before any large scale work could begin in the production of this crop

With these objectives in mind ten soybean varieties were yield tested at Central Farm, monthly. The varieties tested were improved Pelican, San Pablo and Blanca all from Guatemala and Wayne, Clarke 62, Hampton, Hill, Lee, Davis and Coker 240 from the U.S.A. The experiments were always laid down around the middle of every month if weather permits.

Materials & Methods

Site: Riverside Area, Central Farm.
Design: Completely randomized block with 4 reps.
Planting Date: 15 - 16th of everymonth.
Preplanting Cultivation: The sites were ploughed and harrowed in order to give a medium fine tilth.

Fertilization Applications

(a) Type - 18:46:0 and muriate of potash
(b) Rate - 18:46:0 at 200 lbs/acre equivalent 6KCL at 100 lbs/acre equivalent.
(c) Methods: The fertilizer were mixed together and hand broadcasted over the entire area as uniformly as possible.

Insect Control: Dust with Aldrin at the rate of 2 lbs. per acre of 40% w.p. to control soil-bore insects.

Results and Discussion:

From Table: It can be seen that the most appropriate time to plant soybean in the Cayo District is the middle of November, incidentally this is also the best time to plant R.K. Beans. This Table also shows the Three varieties which were obtained from Guatemala to be better than any obtained from the U.S.A.

In so far as pest is concerned it should be mentioned that no serious problems really affected the crops. However we have found that if soybean is allowed the mature during the wet period of this country, considerable loss will be experienced due to poor quality seed.

It has been shown that the yields reduces as the day length shortens.

TABLE VI

Av. Monthly Yields of Soybean Varieties 1967 & 1968 Cwt. LA

Varieties	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Improved Pelican	28.5	T.W	4.0	3.5	4.9	15.4	T.W	15.5	14.5	39.5	49.0	31.0
San Pablo	40.3	T.W	1.7	5.0	5.9	8.8	T.W	5.0	15.5	30.8	61.7	46.3
Blanca	23.6	T.W	2.0	4.1	3.8	8.1	T.W	5.4	15.6	36.5	51.5	26.0
Wayne	23.0	T.W	1.4	N.G	N.G	.6	T.W	2.5	12.0	28.7	40.5	36.0
Clarke 63	18.0	T.W	1.7	N.G	N.G	.7	T.W	2.8	8.0	19.0	30.1	22.0
Hampton	.8.0	T.W	2.1	5.2	4.1	10.9	T.W	5.1	10.9	15.8	11.0	7.2
Hill	27.0	T.W	1.9	3.7	3.4	16.3	T.W	10.2	11.3	23.3	49.8	37.9
Lee	15.0	T.W	1.8	3.7	5.6	13.4	T.W	8.0	10.0	17.4	20.1	19.8
Davis	13.0	T.W	1.3	3.4	5.8	8.0	T.W	7.2	7.4	3.2	18.6	17.0
Coker 240	12.0	T.W	1.6	2.0	4.9	9.0	T.W	13.9	9.6	14.08	21.6	19.2

Key: T.W Too Wet.
N.G N. Germination

SECTION II - PASTURE

Legumes - Pasture Introduction Plots

During 1967 several legumes were introduced from Australia and other places with a view to selecting the ones that appear to be adoptable.

The following report considers the performance of these introduced legumes from 1967 through part of 1969 using as the unit of measure the production of total crude protein percent.

Several important features were observed during this phase of investigation concerning persistence in the field, frequency of defoliation, and ability to stand up under different weather conditions. The legumes had to be cut less frequently than the grass plots because they came back more slowly after cutting. During the wet season when humidity is high and growth becomes rather thick the leaves of most legumes, especially the Glycines, become infected with a fungus. Stylosanthis and Centrosema do well under humid conditions of growth, the former particularly resisting insect and fungal damage.

As regards persistence it would appear that the three legumes worth considering are Centro (Centrosema pubescens) Tropical Kudzu (Pueraria phaseolides), and Siratro (Phaseolus atropurpureus). The stand of Glycines has decreased markedly under regular cutting; so also has those of Teramnus uncinatus, Dolichos axillaris and Greenleaf Desmodium. The latter two have all but disappeared. As stated in the Annual Report of Agronomy Section for 1967, Stylosanthis humilis indeed appears to become dormant during the dry season, growth being resumed when the rains begin.

A table has been drawn up to show the performance of legumes that were cut during the period 1967 - 1969. From this table it may be seen that the following legumes are worhly of note.:- Perennial Stylo, Phasey Bean, Centro, Tropical Kudzu and Local Vigna. The legume Siratro should also be considered in view of its tendency towards repaid regrowth and invasion of other plots. A few words need be said about the characteristics of these legumes and their performance at Central Farm.

Perennial Stylo (Stylosanthes guyanensis) has an upright growth habit and grows well on sandy soils of low fertility. As such, it can produce good quality grazing on those soils and raise fertility. Stylo is unpalatable to stock in its early establishment stages and so, is not liable to be grazed out by stocks but is provided time to become fully established. Palatability increases when the stand becomes fully established. This is a legume for high rainfall areas (80" - 120").

The main seed crop is produced in March, the self sown seeds germinating readily. It has been seen that germination of newly harvested seed averaged 7% when untreated and 47% when treated with boiling water.

Phasey bean (Phaseolus lathyroides) is a heavy seeding legume which is best treated as a short term plant because of its unpredictable performance from year to year. It seems to prefer heavier soils and will do well in damp areas that are poorly drained. Although not very bulky Phasey is quite high in crude Protein.

Centrosema (Centrosema pubescens) is definitely one of the promising legumes at Central Farm. Its yield is not only bulky but also persistent, which characteristic has also been shown in its association with various grasses. Centro has been shown to be more resistant to fungal diseases than most other legumes; and its growth during the "dry season" is good.

Centro will do well under all rainfall categories of this country. It is slow to establish but once established will compete well with accompanying grasses and will stand heavy grazing.

Tropical Kudzu (Pueraria phaseolides) must be carefully managed since severe cropping is likely to cause its elimanation from a sward. In association with grasses it seems to do better with clump - forming grasses, and would probably persist longer if the mixture is not too regularly cropped.

Siratro (Phaseolus atropurpureus) is easy to establish, druught resistant and able to successfully compete with weeds. It is a good spreader both by its runners and by its seed which is thrown considerable distances. Siratro will grow under a wide range of rain fall conditions from 35 inches up, being more tolerant of dry conditions than most legumes. As such it may do well in the Corozal and Orange Walk Districts.

This legume will not however, do well on poorly drained soils. Well established siratro should be grazed hard and frequently to prevent dominance of the sward.

Pasture Introduction Plots Total Crude Protein/acre (cwt/acre)

	Samples	1967	1st '68	2nd '68	3rd '68	4th '68	5th '68	1st '69	2nd '69	Total	Average
L1	Perennial Stylo	56.70	14.03	---	---	---	---	---	---	70.73	23.57
L3	Local Vigna	---	---	---	---	11.97	---	---	---	11.97	11.97
L4	Hairy Indigo	35.07	---	---	---	---	---	---	---	35.07	17.54
L6	Phasey Bean	39.14	---	---	---	---	---	---	---	39.14	19.57
L9	Kordofan Pea	---	10.45	24.72	12.45	6.52	---	4.57	---	58.71	11.74
L14	Clarence Glycine	17.38	---	---	2.36	---	---	1.72	2.60	24.06	4.81
L18	Centrosema	62.05	17.51	---	9.91	3.13	---	2.13	5.08	117.99	14.75
L19	Dolichos Axillaris	---	7.79	---	7.19		3.16	---	---	18.14	6.05
L20	Dolichos axillaris	---	---	15.87	13.01	3.33	---	2.91	3.89	39.01	7.80
L21	Dolichos axillaris	---	---	11.39	9.20	3.62	---	1.51	---	25.72	6.43
L25	Clarence Glycine	---	---	4.87	11.59	2.69	---	1.45	---	20.60	5.15
L26	Clarence Glycine	---	---	8.15	9.91	3.77	---	2.41	3.64	27.88	5.57
L27	Clarence Glycine	---	---	5.27	4.49	1.81	---	---	---	11.57	3.86
L28	Clarence Glycine	---	---	6.71	6.35	2.09	---	1.17	---	16.92	4.23

L29	Terammus uncinatus	---	---	12.57	4.68	---	---	1.81	---	19.06	6.35
L30	Terammus uncinatus	---	---	14.89	5.16	3.04	---	1.65	---	24.74	6.18
L31	Hyacinth Bean	---	---	---	16.72	---	---			16.72	16.72
L32	Trop. Kudzu	82.68	14.30	4.05	3.62	---	3.56			108.21	18.04
L34	Vigna marina	---	---	16.53	---	5.97	---			22.50	11.25
L35	Local Vigna	---	19.34	25.59	---	---	7.12			52.05	17.35
L36	Siratro	---	---	10.45	13.49	---	3.46		3.17	30.57	7.64
L37	Centrosema	---	17.58	---	---	---			---	17.58	17.58
L38	Centrosema	---	17.03	16.71	12.06	---	3.03		9.88	58.71	11.74
L39	Greenleaf Desmod	---	5.07	8.02	---	---	3.37			16.46	5.48
L40	Centrosema	---	35.76	25.60	15.94	8.28	---		10.59	96.17	19.23
L41	Glycine cooper	17.80	---	9.39	4.39	---	1.59			33.17	6.63
L45	Centrosema	---	---	17.29	10.32	---	---		7.98	35.59	11.86

SECTION III - PLANT PROTECTION

The year 1969 was the second full year of operation by this section. The Plant Pathologist continued to be in charge of both Plant Pathology and Entomology. The staff consisted of the Plant Pathologist and F.D. Garcia as assistant. Field labour was supplied by the Agronomy Labour force. Work was continued in recording and cataloging the pests and diseases of the economic plants of our country. From these records, data will be obtained which will show what the major problems are and thus to enable us to determine priorities so that we can most efficiently allocate our limited resources.

Almost all the insect specimens we have collected and identified are pests on crops. Some are parasites on weeds and other herbage and some are parasites and predators of other insects. Some 300 specimens are already identified and a large number that are as yet unidentified. Almost all the identified insect species were done by the Commonwealth Institute of Entomology. Almost all the Curculionids are not yet identified because of shortage of specialists in this group. It is hoped that in a few years our reference collection will be comprehensive enough to dispence with the need of sending insect specimens abroad for identification except for new or rare species. Already we have done a few identifications for institutions within the country.

No collection has yet been started for pathogenic fungi or bacteria. The reason for this is a lack of proper facilities for storing cultures. But it is hoped that a start will be made in this area in 1970. All the Identifications of fungi and bacteria in this report were done by the Plant Pathologist. Some of the identifications may need confirmation as to species.

During the course of the year some field research was done on rice and maize. Two trials were laid down on rice to evaluate varieties and fertilizers in controlling the major diseases in this crop in the country. Despite problems due to failure of machinery, the first rice trial in January gave a good indication of the optimum fertilizer nitrogen to potassium ratio (N : K) in controlling brown leaf spot (BLS) and rice blast disease (RBD). Varieties used were Nilo 47, IR - 5 and IR - 8. A similar trial was laid down at Gales Point in July but had to be abandoned because of transportation and communication difficulties.

Research began in 1968; was continued this year on the economics of control of the fall - army worm on maize. The first trial was laid down on early June. Its purpose was to determine the number and timing of applications of insecticides in controlling the fall - army worm. The second trial, in late June was to evaluate both varieties of maize and different insecticides in controlling the fall-army worm.

MAIZE: Timing and Number of Application of Insecticides.

From observations it is apparant that army worms prefer the corn crop only during certains stage in its development. The purpose of this trial was tofind out what this stage was and then number of applications necessary to control the pests.

MATERIALS AND METHODS: The synthetic corn variety VS 550A was planted in a block 60 ft. x 300 ft. (0.4A) which was subdivided into 20 plots 12 ft. x 75 ft. (0.02A) each. A randomized block design with 5 treatments replicated 4 times each was used. The treatments were as follows : A - Control. B-Weekly spraying. C - Biweekly Spraying. D - Weekly first 4 weeks and/weekly 4 weeks around flowering spraying. E - Biweekly as for D. Spraying were done with a Kestrel Polypak knapsack sprayer. Didimac (DDT 25% C) was used at the rate of 4 Ozs. in 3 U.S. gallons of water.

RESULTS : The spraying had to be discontinued before the plants started flowering because they got too tall for the polypak sprayer and no high clearance spraying equipment was available. So actually treatments D and E became replications of treatments B and C respectively. Table 1 shows the yields obtained under the different treatments.

Table VIII : Yields (in lbs) from Corn Insecticides Timing Trial

	TREATMENTS						
Replicates	A	B B C	C	D	E	Total	Mean
1	52.00	60.00	59.25	64.00	70.25	306.00	61.20
2	61.00	59.25	56.00	61.50	56.00	293.75	58.75
3	45.25	76.25	52.00	56.25	5300	282.75	56.55
4	42.50	57.00	65.25	71.00	60.50	396.25	59.25
Total	200.75	252.50	232.50	252.75	240.25	1,178.75	----
Mean	50.19	63.12	58.12	63.19	60.06	-----	58.94 General Mean

TREATMENTS				MEAN	STANDERED ERROR
A	B	C	E		
200.75	252.50	232.50	240.25	235.75	18

-----	Control	Weekly Spraying	Biweekly Spraying	Weekly Bi-weekly	Mean	Std. Error
Mean Yields/ /A	16.06	20.20	18.60	20.22 19.22	18.86	1.4
Mean Yields % .	85.2	107.0	98.7	107.2 101.7	100.0	7.6
Yields(lbs)A	4,226.3	5,315.8	4,815.0	5,383.0 5,165.0	4,981.4	

Conclusions : From the statistical results obtained it is clear that all treatments gave significantly higher yields than the checks. But the differences between treatments were not significant. This means that spraying weekly is no more effective than spraying every other week for control of the fall army worm.

The savings that can be realized by two sprayings when the army worm is doing serious damage are in the order of 1,000 pounds of grain per acre. Thus, by investing under $10.00 in pest control a saving of $ 50.00 or more may be realised.

Another point to note is the fairly high yields of the VS 550A obtained with proper fertilizer application and weed control. Add pest control to this, and yields well above 5,000 lbs. grain per acre can be obtained.

MAIZE : VARIETY and INSECTICIDE TRIAL

Since the fall army worm (Spodeoptera Frugiperda) is a serious pest on this crop almost every year, it is decided to test varieties for resistence to the pest. At the same time, 4 insecticides were tested for effectiveness in controlling the insect.

MATERIALS and METHODS : The hybrids Poey T 66 and X 306, the synthetic variety VS 550A, and the open pollinated varieties Sintux, Arlequin and Tequisate were planted in individual blocks of 258' x 608 (ap. 0.36A). The blocks were divided into 10 plots of 51.6' X 30' (ap.0.036 A) each. Treatments were control, DDT,- Telodrin, Telodrin granular, and Lannate each replicated twice in each block. The rates used were DDT - 4 ozs. (Didimac 25% EC) in 3 U.S. gallons of water; Telodrin 60 mls. in 3 U.S. gal; Lannate 1 oz. in 3U.S. gal. and Telodrin 2% granular at the equivalent rate of 10 lbs. per acre.

A Kestrel Knapsack sprayer was used to apply the sprays and the granular material was applied by hand into the funnels of the corn plants. The first application was made on the 24th June and a second application was made on the 30th. June when there was a second wave of army worm.

RESULTS : All varieties were harvested in November and the weights of the grain taken at 14% moisture content. Table 1 shows the weights per plots for the different varieties and treatments.

MAIZE : YIELDS of VARIETY and INSTECTICIDE TRIAL.

Table IX : TREATMENT YIELDS (lbs)

Variety	Control	Telodrin	Telodrin Granular	DDT	Lannate
VS. 550A	146.7	195.2	152.5	179.0	222.8
Poey T 66	128.5	189.3	232.2	210.8	180.0
X 306	247.0	302.6	298.0	302.6	281.0
Sintux	225.0	247.0	262.0	225.3	198.7
Arlequin	192.0	111.7	196.0	220.0	204.0
Tequisate	171.0	234.2	272.0	194.2	208.5

Conclusions : Lannate was significantly more effective than DDT or Telodrin only on the variety VS 550A. Telodrin granular was significantly more effective than Telodrin only on the varieties Sintux, Arlequin and Tequisate. The varieties VS 550A, Poey T 66 and X 306 showed much higher response to insecticide treatment than the varieties Sintux, Arlequin and Tequisate. This indicates that the three former varieties are more susceptible to army worm damage than the three latter varieties.

RICE BLAST TRIAL

OBJECTIVES

This experiment was designed to determine the most effective nitrogen to potassium ration (N:P) in combatting the rice blast disease caused by the fungus Piticularia oryzae.

MATERIALS AND METHODS

A piece of land in the Horticultural Section, Central Farm about 1/5 acre (64ft. X 136 ft.) was divided down its length into 3 blocks with a 2 ft. walkway between the blocks. The rice varieties Nilo 47, Nilo 3 and IR - 5 were seeded at the rate of 100 lbs. per acre. Each block was planted with one variety only. Each block was divided into 16 plots of dimensions 8.5 ft. X 20 ft. (1/260 acre).

At planting all plots were fertilized with an equivalent of 100 pounds of Triple Superphosphate (T.S.P.) per acre. The other fertilizers were at the following levels:-

A	-	150	lbs.	Urea	+ 100	lbs.	KCl.
B	-	200	lbs.	"	+ 100	"	"
C	-	300	"	"	+ 100	"	"
X	-	100	"	"	+ 150	"	"
Y	-	100	"	"	+ 200	"	"
Z	-	100	"	"	+ 300	"	"

The control plot was fertilized with an equivalent of 100 pounds Urea + 100 lbs. T.S.P. - 100 lbs. KC l per acre. The Urea fertilizer for each plot, except that of the control plot, was divided into two portions at an approximate ratio of 2:1 and each portion, which was the basic application, was done at planting. This was as follows. All rates are per acre equivalent.

A	-	100	lbs.	Urea	X	-	70 lbs. Urea
B	-	125	"	"	Y	-	70 " "
C	-	200	"	"	Z	-	70 " "

The second application which was the 1/3 portion was supplied two months later as follows:

A	-	50	lbs.	Urea	X	-	30 lbs. Urea
B	-	75	lbs.	"	Y	-	30 " "
C	-	100	"	"	Z	-	30 lbs. "

The seed was sown by hand in narrow furrows. The basic application of fertilizer was broadcast and the second application was also broadcast after the land was drained. Irrigation was by flood using a pump. Harvesting was done by hand. Inoculation ofthe blast fungus was obtained from old rice straw from Big Falls Ltd.

The Nilo 3 failed to germinate and so this block had to be abandoned. The pump was non-functioning for a while which resulted in inadequate water in higher areas. Birds took a heavy toll of the crop before it harvested. The following tables give the results obtained:-

TABLE X

YIELD DATA ON RICE VARIETY (IR - 5)

Fertilizer Treatment	Weight of Grain Unfanned		Weight of Grain Unfanned		Weight of Blasted Grains	Percentage Blasted Grain
	(lbs.)	(ozs)	(lbs)	(ozs)	(ozs.)	
AZ	4	1	3	8	3	4.6
CY	6	8	5	11	12	11.5
RZ	7	6	7	1	4	3.3.
A	6	14	6	10	3	2.7
BY	8	5	7	6	12	8.9
AX	6	10	5	11.5	10.5	9.9
BX	7	9	6	10	12	9.9
CZ	11	2	10	1.5	6.5	3.6
Y	14	6	13	9	10	4.4
CX	9	14	9	0	7.5	4.7
C	14	15.5	13	13	17	7.1
AY	15	9.5	14	6	10	4.0
Z	8	6	8	0	4.5	3.3
B	10	4	9	7	10	6.1
X	6	0	5	2	11	12.2
CON	1	1	0	12	4	2.5

TAPLE XL

YIELDS DATA ON RICE VARIETY NILO 47

Fertilizer Treatment	Weight of Grain Unfanned		Weight of Grain Unfanned		Weight of Blasted Grains		Percentage Blasted Grain
	(lbs)	(ozs)	(lbs)	(ozs)	(lbs)	(ozs)	
B	0	2	0	1	0	0.5	
BX	0	4.5	0	3	0	1	22.2
BY	0	8	0	5.5	0	2	25
CZ	1	4	0	14.5	0	4	20
A	1	1	0	14	0	4	23.5
CON	0	15.5	0	12	0	3	19.3
CY	1	11	1	5	0	6	22.2
C	3	7	2	14	0	6	10.9
AY	3	13	2	15	0	7	11.4
X	2	8	1	11	0	12	30
CX	2	7	1	8	0	14	35.8
Y	2	13	1	12	0	15	33.3
BZ	3	4	1	12	1	4	38.4
Z	3	4	1	10	1	4	38.4
AZ	1	14	0	12	0	14	46.6
AX	1	8	0	8	0	13	54.1

Close obserbation of the data on Tables 1 & 2 shows the following:-

IR - 5

Highest yields : AY, C, Y, CZ, B in decreasing order of magnitude.
Highest Blast %: X, CY, AX, CX, BZ, Y in decreasing order of magnitude.
Highest Blast by Weight : C, CY, BY, X, AX, Y, AY, in decreasing order of magnitude.

Nilo 47

Highest yields : AY, C, BZ, Z, CX, Y, in decreasing order of magnitude.
Highest Blast % : AX, AZ, Z, BZ, CX, Y in decreasing order of magnitude.
Highest Blast by Weight : Z, BZ, Y, CX, AX, X in decreasing order of magnitude.

Although, as previously mentioned, the NILO 47, being earlier maturing than the IR -5, was more severly damaged than the IR - 5. The information obtained from the two varieties agrees very closely and gives a good indication of the effect of the fertilizer on the blast disease of rice. This same information applies to brown leaf spot on rice (Helminthosporium oryzae) disease also. The trial became naturally infected with this fungus, and it is known that this disease responds to the N:K ratio also. Observations bear this out.

The data shows in both varieties that the treatment AY gave the highest yields and the lowest percentage of blasted grain. This corresponds to 250 lbs. Urea + 300 lbs. of KC 1 per acre. The highest (second) yields in both varieties was treatment C, 300 labs. Urea + 100 lbs. KC 1; but this treatment also had a high percentage of blasted grain. The third highest yields in IR - 5 and the 5th in Nilo 47 was treatment Y, 100 lbs. Urea + 200 lbs. KC 1. In this treatment percentage blast was very low. The controls had relatively low percentage of blast but had very low yields.

The rest of the data shows that whereever the Urea application exceeds that of KC 1, the incidence of blasted grain is increased. This is also true where KC 1 application exceeds 300 lbs. per acre. This is probably due to toxicity of excess potassium.

SUMMARY AND CONCLUSION

A trial laid down to obtain data on rice blast disease also yielded data on control of brown leaf spot. Although several factors beyond our control intervened to render the data unsuitable for statistical analysis, the results obtained gave a very good indication of the effect of the N:K ratio on the diseases in question.

The data showed that the optimum N:K ratio corresponds to 250 lbs. Urea + 300 lbs. KC 1 per acre. Any treatment where the Urea application was higher than the KC 1 resulted in increased blast and any treatment where the KC 1 application was greater than 300 lbs. per acre resulted in decreased yields and increased percentage blast.

It is hoped to continue this line of investigation under more favorable conditions and on the major soil types on which rice is grown in the country. It would also be worthwhile to determine if phosphorus has any influence in this set up.

LIST OF PLANT DISEASES OF ECONOMIC IMPORTANCE RECORDED IN B.H. 1969

HOST CROPS	DISEASE	CAUSE
Rice (*Oryza Sativa*)	Brown Leaf spot	*Helminthosporium sp.*
	REMARKS: Countrywide; 5-5% crop loss; degrees of resistance.	
"	Disease	CAUSE
	Seed blight	*Helminthosporium sp.*
	REMARKS: Countrywide 2 ditto crop loss; degrees of resistence.	
"	DISEASE	CAUSE
	Glume blight	*Curvularia Lunata*
	REMARKS: Usually in association with insect damage milling quality affected.	
"	DISEASE	CAUSE
	Hoja blanca	virus
	REMARKS: The insect vectors usually spread late in the year.	
"	DISEASE	CAUSE
	Blast	*Piricularia oryzae*
	REMARKS: Painting during the cool part of the year affected; degrees of resistence.	
MAIZE (*Zea mays* L)	DISEASE	CAUSE
	Blight	*Aenolomia Postica*
	REMARKS: This cane pest seems to be increasingly affecting other crops.	
"	DISEASE	CAUSE
	Leaf spot	*Helminthosporium sp.*
	REMARKS: About 10% crop loss in early planting.	
"	DISEASE	CAUSE
	Rust	*Puccinia Polysori*
	REMARKS: Country wide, but appearing only near maturity of crop.	
"	DISEASE	CAUSE
	Corn Stunt	virus
	REMARKS: Usually only a very small percentage of plants affected.	
BEANS (Phaseolus vulgris L)	DISEASE	CAUSE
	rust	*Unromyces phaseoli*
	REMARKS: Dependent on weather, but usually devastate late plantings.	
	DISEASE	CAUSE
	web blight	*Rhizoctonia microsclerotia*
	REMARKS: Early plantings seem more affected; can wipe out a field.	
	DISEASE	CAUSE
	Crown rot	*Sclerotium rolsii*
	REMARKS: Generally 5% - 10% loss in stand.	
	DISEASE	CAUSE
	Mosaic	virus
	REMARKS: Dependent on factors, but degrees of resistance in host varieties.	

BEANS (Phasoelus vulgaris L)

DISEASE: Leaf spot — CAUSE: Cercospora sp.
REMARKS: Common on plants weakened by iron deficiency.

"

DISEASE: Root-knot — CAUSE: Meloidogyne sp.
REMARKS: The incidence of this nematode seems to be increasing.

"

DISEASE: Bacterial blight — CAUSE: Pseudomonas sp.
REMARKS: Reported from the Stann Creek Dist. only. (DISEASE : Iron Deficiency.)

"

DISEASE: cholorosis — CAUSE: iron deficiency
REMARKS: Common in Corozal, Orange Walk, Cayo, Belize and Stann Creek Districts.

UITS:
Carica papaya

DISEASE: root rot — CAUSE: Fusarium sp.
REMARKS: More common in the Northern Districts; degrees of resistance.

"

DISEASE: mosaic — CAUSE: virus
REMARKS: Countrywide; infected plants killed gradually.

"

DISEASE: fruit rot — CAUSE: Colectotricum sp.
REMARKS: Usually affected before harvest.

ANNONA sp.

DISEASE: antracnose — CAUSE: Colectottrichum sp
REMARKS: Countrywide; very common; affects foliage and fruits.

Magnifera indica L

DISEASE: ANTRACNOSE — CAUSE: Gleosporium sp.
REMARKS: Countrywide; ditto; affects foliage and fruit.

"

DISEASE: leaf spot — CAUSE: Cercosnota
REMARKS: Countrywide; ditto; affects foliage and fruits.

Parsaa americana

DISEASE: L Blight — CAUSE: Cercoapora purpure
REMARKS: Countrywide; very common; defoliates plants and cause fruit drop and blemished fruit.

"

DISEASE: scab — CAUSE: Sphaceloma
REMARKS: Blemishes fruits; degrees of resistance.

Magnifera indica L

DISEASE: leaf distortion — CAUSE: 2,4-D weedkiller
REMARKS: The mango is very sensitive to trace amounts of this herbicide.

Cocos nucifera

DISEASE grey blight — CAUSE Pestalotia Palmarum
REMARKS: Countrywide on all types of palms.

"

DISEASE yellows — CAUSE Thielaviopsis paradoxa
REMARKS: Foliage becomes a bright yellow then tree dies.

"

DISEASE red ring — CAUSE beetle/nematode
REMARKS: Affected trees are killed gradually

"

DISEASE leaf spot — CAUSE Helminthosporium (incurvatum)
REMARKS: Found only on seedlings in the nursery.

Prunus sp.

DISEASE gummosis — CAUSE virus (?)
REMARKS: Countrywide; gradual death of plants.

Vegetables:
Lycopersicon esculentum

DISEASE bacterial wilt — CAUSE Pseudomonas solancearum
REMARKS: Tomatoes cannot be grown in some areas because of this bacterium.

"

DISEASE Fusarium wilt — CAUSE Fusarium oxysporium
REMARKS: Widespread; but some resistance in some varieties

"

DISEASE Early blight — CAUSE Alternaria solani
REMARKS: Usually older leaves only, but occasionally flarres up.

"

DISEASE grey mold — CAUSE Cladosnorium fulvum
REMARKS: Unthrifty plants are more easily affected.

"

DISEASE blossom-end rot — CAUSE Physiologi cal
REMARKS: Mostly in Calcium deficient areas; degrees of resistance.

"

DISEASE fruit splitting — CAUSE Physiological
REMARKS: Associated with water stress.

"

DISEASE Root knot — CAUSE Meloidogyne sp.
REMARKS: Countrywide; common.

Brassica spp.

DISEASE black rot — CAUSE Xanthomones compestris
REMARKS: Common; degrees of resistance.

"

DISEASE yellows — CAUSE Fusarium oxysporium
REMARKS: Common; degrees Ditto of resistance

"

DISEASE Bacterial soft rot — CAUSE bacteria
REMARKS: Proceded by insect damage in soil.

Cucurhits	DISEASE Gummy stem blight	CAUSE Mycosphaerella melonis
	REMARKS: High percentage of culls in expert cucumbers.	
"	DISEASE Downy mildew	CAUSE Pseudoperonospora cubensis
	REMARKS: More common in the dry part of the year.	
"	DISEASE Powdery mildew	CAUSE Erysiphe polygonum
	REMARKS: Generally distributed.	
"	DISEASE Anthracnose	CAUSE Colletotrichum sp.
	REMARKS: Especially on water melon.	
ONIONS	DISEASE leaf blight	CAUSE Alternaria norri
	REMARKS: More severe in moist periods.	
LETTUCE	DISEASE leaf spot	CAUSE Cercospora sp.
	REMARKS: Not very common.	
"	DISEASE leaf blight	CAUSE Alternaria sp.
	REMARKS: In favourable weather can destroy a crop completely.	
POLE BEANS	DISEASE Powdery mildew	CAUSE Erysiphe polygonum
	REMARKS: Found in the early part of the year.	
"	DISEASE leaf spot	CAUSE Cercospora sp.
	REMARKS: Mostly on weakened plants.	

SECTION IV ANIMAL HEALTH

The country continued to remain remarkably free of diseases including anthrax, blackquarter, rabies, and swine fever. In one case the possibility of anthrax could not be ruled out - blood films were not submitted - and the area involved was scorched by flame - thrower. No further suspicious cases occurred.

One can but re-iterate an earlier comment that this freedom from disease is a most valuable asset which calls for continuing, and indeed increasing, vigilance as the industry develop and the density of the livestock population increases.

Disease control legislation is still pending, and there is a great need for public education especially in relation to reporting scheduled diseases.

Even within the Department, knowledge of scheduled diseases and of procedure is still rudimentary but it is doubtful if very much progress can be made until staff can be specifically allocated to livestock work and then be required to have a more detailed understanding and higher standards than can reasonably be expected of the general farm demonstrator.

Reporting of diseases found at slaughter by Health Department staff is now fairly well established, and the Belize slaughter house is visited once weekly by the laboratory technician for a spot check on parasitism, mastitis, brucellosis, leptospirosis and other disorders.

1. VESICULAR DISEASE

No significant outbreak of vesicular stomatitis occured during the year although some evidence was noted of old individual cases which had not been reported.

In the absence of a port inspector there must always be some uneasiness about ships arriving from Europe, South America, and the Far East, and for instance, discharging galley refuse into the harbour, although it is doubtful if anything remotely resembling a meat scrap would evade the vigilance of the catfish.

2. SWINE FEVER

There was no outbreak of swine fever during the year.

As a precautionary measure, since compulsory mass vaccination is not feasible, farmers wishing to purchase breeding stock from the Department are now required to have their herds vaccinated.

This is intended both as enforced protection of the more valuable herds and to serve at least as a particular barrier to hinder the spread of the disease should an outbreak arise.

There is little doubt that, apart from an unknown risk from wildlife, the major danger of introduction is by the trucks of Mexican traders who ply from farm to farm buying pigs, poultry and other produce.

A proposal has been made that such vehicles should undergo decontamination on entry but funds for the very simple facilities required have not yet been made available.

3. RABIES

There was no outbreak of rabies during the year, a happy situation unfortunately shattered in the first few days of the new year. Perhaps in the aftermath local authorities will take their responsibilities in the matter of dog licensing and the control of strays a little more seriously.

The background to the threat of bovine rabies was outlined in some detail in the writer's last Annual Report, and reference has already been made to the establishment of a vampire bat control programme.

First results are very encouraging in that, apart from securing the information we need about the bats, it seems that the operation can be of immediate practical benefit to farmers.

4. TICK- BORNE DISEASE

Anaplasmosis and Babesiosis are, presumably, both enzootic through out the country but present evidence indicates the latter as being more important and frequently highly virulent.

Tick - borne disease thus represents a major risk to cattle introduced from tick-free areas and indeed to native high-grade B taurus cattle.

Both the Department and B.S.I. Ltd., as major importers, have suffered losses during the year.

It is difficult to guard against per-acute babesiosis and some losses from this source must be considered as part of the Price paid for the introduction of highly productive stock.

Losses can be reduced by a combination of vaccination against anaplasmosis, antibiotic feeding, and careful vigilance, with prompt treatment if necessary. In the case of imported in-calf heifers antiviotic feeding should be continued until after calving.

5. TUBERCULOSIS

6. BRUCELLOSIS

Neither of these diseases is recognised as a clinical problem at the present time. An occasional case of tuberculosis is reported from slaughterhouses and agglutination testing has revealed the odd positive reaction for brucellosis.

Mr. Hill Veterinary Officer tuverculin tested 300 cows on 30 farms at Spanish Lookout with three doubtful reactors, all negative on re-test.

As imported cattle are required to be free of these diseases there is no reason why, with continuing vigilance and occasional screening they should ever become established here.

When resources are available the suggestion of a pilot eradication programme made last year could be revived to ascertain the possibility of eliminating reactors to both conditions to the point of insignificance.

7. ACTINOMUCOSTS

Two cases of this condition were noted during the year being the first positive confirmation of its occurence.

Both were from the Boom area, one a typical case in a bovine jaw, the other in a pig's ear evidently from a wound infection.

8. LEPTOSPIROSIS

Although a number of positive reactions were noted in agglutination tests carried out using antigen kindly suffered by our friends in the University of Connecticut, this disease was only recognised clinically dogs (see below)

In January, however, a high agglutination titre in a sow which had aborted, with negative results from other pigs in the neighbourhood gave the first presumptive evidence of a clinical outbreak in pigs.

9. TETANUS

Occasional cases of tetanus occur but relatively few owners even of the more valuable racehorses take the precaution of having their animals vaccinated.

Tetanus is less of a hazard to the livestock industry than to the lives particularly of children living in towns such as Cayo where large numbers of horses are allowed the freedom of the streets.

10. PIG PARALYSIS

Few cases of this syndrome were noted during the year and it was not possible to pursue investigation beyond the limit reached last year.

All reports in the pathology of the condition appear to agree that the CNS lesions are not diagnostic of any known infections agent or poison.

The 'plausible hypothesis' has been advanced of poor sanitation and probably poor diet as being the cause of the lisions, but this does not satisfactorily account for either the clinical picture or the epidemiology.

The condition remains something of an enigma and will be further investigated when opportunity permits.

11. CUTANEOUS HABRONEMIASIS

Sporadic cases of this condition occur but the writer has seen none comparable to the formidable 'espundia' of South America.

Microscopic confirmation was recorded for the first time in British Honduras in an outbreak in horses stabled at the National Stadium.

In addition to sanitar. measures, one horse with multiple lesions was treated experimentally with 'Neguvan' given by intramuscular injection in the neck.

The rapid healing of the lesians which ensured was undoubtedly assisted by the slight but painful swelling which persisted for a few days at the site of injection and which discouraged the horse from moving his head sideways to bite at the affected areas.

12. DISEASES OF POULTRY

Inevitably, with severe limitations of staff and resources, attention to poultry has been somewhat neglected. This situation has however been redressed to some extent butthe assistance received from the University of Connecticut, in this case particularly Dr. M. Fraxier.

As with other livestock, parasitism is severe, and serious infestation with roundworms, tapeworms and coccidia is virtually unavoidable unless the birds are kept off the ground.

Two simple measures, if adopted, would make an i immediate impact on poultry production - housing on slatted floors and provision of a malathion dust bath to control ectoparasites.

Of infectious diseases, the most dramatic is a condition which typically produces sudden death, allegedly often while the owner is observing his apparently normal birds, or a number of birds are simply found dead in the morning

This is usually attributed to cholera but this has not yet been confirmed microscopically and one head subjected to histological examination in Connecticut was reported to have lesions consistent with a diagnosis of Newcastle disease.

A constant risk of introduction of Newcastle disease (like swine fever) is presented by the number of Mexican trucks which come over and are driven from farm to farm seeking poultry and eggs. Reference has already been made to the need for a border decontamination station.

One of the commonest diseases of chickens and a major problem to turkey rearing is fowl pox.

Two problems in introducing vaccination are the short shelf-life of the vaccine, and the risk where the disease is common of vaccinating birds already exposed to infection which may then break down and destroy the confidence of producers.

Vaccination was introduced experimentally in two areas - Corozal and Crooked Tree (the latter a main turkey rearing area).

The 'take' was estimated as 90% and 85% respectively, and at Crooked Tree where mortality in vaccinated birds was about 1.5% mortality among un-vaccinated birds, especially turkeys, was estimated to be in the region of 50%.

An unusual condition found at post-mortem was apparently a mycotic peritonitis probably an extension of lung infection.

A condition which has so far eluded identification is 'pip' not described in any available poultry texbook but accorded an entry in the Concise Oxford dictionary. A bird said to be affected by pip, was examined in Connecticut and found to have Tapeworms, crop lesions due to Capillatia, and chronic Respiratory Disease -which may, of course be what 'pip' is, not a disease, just ill health.

Perosis has been noted on a number of occasions, including one instance in ducklings which is apparently rare. It is not yet known to what extent this may reflect a soil manganese dificiency or be simply due to feeding malpractices and nutritional imbalance.

Vitamin E dificiency (Crazy chick disease) was diagnosed by Dr. Frazier in a flock the owner of which had found a 'cheap' high-protein ration by using a very high level of unextracted coconut meal with a consequent 50% mortality among his chickens.

13. DISEASES OF DOGS

Treatment of dog (and cat) ailments is largely confined to the more sophisticated owner population of Belize City.

The most important conditions encountered are leptospirosis and infestation with heartworm, hookworm and tapeworm.

Distemper occurs sporadically and outbreaks were noted in Corozal and (probably) AmbergrisCaye. Probably many dogs succumb to unrecorded infection at an early age or acquire a natural immunity, while an increasing number of dogs are being protected by vaccination.

Leptospirosis and heartworm are major causes of death in dogs in Belize City, partly due to the fact that cases are often presented for treatment at an advance stage.

With improved reasources for both diagnosis and treatment now available, it should be possible to improve on our success rate during the coming year.

It is also hoped to carry out some investigation of the incidence of leptospirosis in dogs, rats and human in the City. A possibility exists that partial control of rats may innrease the incidence of leptospirosis by lowering the average age and increasing the susceptibility of the rat population.

Advantage was taken of the destruction of a number of stray dogs by the Health Department to examine them for heartworm infestation. Of 28 dogs examined, 17 had adult worms.

Alternate use of thenium compound and diethylcarbamazine is being recommended to control hookworm and to reduce the spread of heartworm but with large number of dogs remaining untreated this is only a partial solution particularly to the latter problem.

14. EQUINE ENCEPHALITIS

An extensive outbreak of Equine encephalitis occured about the middle of the year on the El Salvador - Guatemala border, subsequently involving Honduras and spreading from the Pacific to the Atlantic coast with the loss of several thousand horses.

This was caused by the Venezuelan strain of virus for which there is no commercial source of vaccine, and efforts were made through the U.S Consulate and other channels to obtain vaccine from the AMRIID establishment at Fort Detrick, Maryland.

All efforts failed until Dr. Kersting took up the matter on our behalf with the British Embassy in Washington. Having explained to the embassy staff the nature of the problem (and the whereabouts of British Honduras) he was given an appropriate contact in the State Department, and the vaccine was obtained - an excellent example of the superiority of personal contacts over "correct Channels".

Vaccination was begun in Toledo and continued in Cayo in the New Year.

The disease reached Peten but seems to have died out as it reached our border. It remains to be seen whether there will be any recrudescence with the outset of the next rainy season.

12. MISCELLANEOUS

POISINING: As was noted in the last animal report, one is usually reluctant to diagnose poisoning, including shake-bite, in the absence of positive confirmation (which is often difficult) but a number of cases do occur which cannot be attributed to any other cause.

Considering the widespread and sometimes indiscriminate use of chlorinated hydrocarbon and organophosphrus pesticides, it is perhaps surprising that more cases of poisoning from these substances do not arise.

One dog died after being bathed in an excessively strong solution of coumphos, but the most spectacular case was poisoning in pigs fed on bran milled from aldrin-dressed seed rice and sold in error for feeding.

Some thirteen pigs died of more or less acute poisoning and fifty seven others, some with sub-acute symptoms, others sumptonless were slaughtered on the ground of probable risk to human health in the event of their being retained for consumption.

Samples of fat were analysed through the good offices of Dean Kersting in Connecticut and were found to contain 6.5 ppm. dieldrin/ aldrin - some 20 times the U.S.D.A. Permissible limit.

BOTULISM: Reference was made last year to a syndrome in cattle believed to be the classical phosphorous difiency / botulism association.

Cases of botulism were observed this year in dogs and poultry at Boom, probably due to toxin in the carcase of a dead iguana. It was interesting that the owner, although ignorant of the term "limberneck" applied to the condition nevertheless used the 16th century word to describe the birds which also showed the typical sympton/...

of loose feathers.

It seems probably that botulism is responsible for an appreciable proportion of unexplained paralytic illness and sudden deaths.

WARTS: Outbreaks of warts in cattle appear from time to time and 1969 seems to have been a 'bad year'. Both wart vaccine and anthiomatine are used together with local treatment, the success rate tending to depend on the time and effort the owner is able, or prepared, to devote to the problem.

VENEREAL GRANULOMA: A number of cases of this condition have been encountered in dogs in Belize City, some with gross advanced lesions Although early cases appear to respond to treatment, satisfactory control like heartworm, requires action at the community level, which is not feasible at the present time.

MASTITIS: Increasing numbers of cases of mastitis in cows and sows are coming to light, probably as owners become more aware of the ditions and the possibility of treatment.

From each few examinations as have been caried out so it seems that staphylococci are commonly responsible probably favoured by the warm humid climatic conditions.

In the writer's opinion the incidence of mastitis, both important factor to be taken into consideration in development of the diary industry.

PARASITISM: In horses, cattle, pigs, poultry and pets, parasites are a major cause of ill-health and economic loss.

Roundworms, tapeworms, lungworms, kidney worms and coccidia all contribute to the general malaise.

Notable omissions apparently include Histomonas mecagridis and Syngamus trachea while only very occasional cases of fascioliasis are observed at meat inspection. The incidence of Dermatovia infestation is likewise very low, much below that in the neighbouring areas of Honduras and Guatemala.

Farmers appear to be making increasing use of routine treatment for worms, but changes in management and husbandry which are equally important in parasite control will take rather longer to materialise.

In some cases, for instance cattle lungworm, our knowledge of the natural history of theparasite under local conditions is as yet inadequate for firm recomendations on strategic medication, and it is hoped that further information on the relative importance and seasonal incidence of different parasites can be determined by the laboratory during the coming year.

16. CLINICAL TREATMENTS:

Although records of clinical treatments are incomplete and do not give a true picture of work carried out, a considerable increase in the scale of our activity is necessary to provide anything like an adequate service to the farming community.

At the same time it is not the function of a state service to provide (often uneconomic) service to farmers which they should very well be able to carry out themselves.

There must therefore be a continuing programme of education, supported by more in the way of simple, "do it yourself" literature, thereby allowing Departmental staff to concentrate on matters requiring more sophisticated treatment, and as disease control procedures and submission of material to the laboratory.

Facilities for surgery are somewhat limited but, in addition to numerous fractures and wound rapairs, cases included hysterectomy, Caesarean section.

Section V ACKNOWLEDGEMENTS

The Department wishes to express its gratitude for the continued help received from other Government Departments, Commercial concerns and private individuals.

(E. W. KING)
Chief Agricultural Officer
M/Agriculture, Lands and Co-operatives

APPENDIX 11

SUMMARY OF RAINFALL 1969

District and Stations	JAN	FEB	MAR	APR	MAY	JUNE	JUL	AUG	SEP	OCT	NOV	DEC	Total 1969	Total 1968	10 yrs. Av.
COROZAL															
Corozal Agstat	3.80	0.42	1.40	0.94	8.21	8.78	7.25	10.81	11.51	4.52	6.42	NIL	64.06	46.06	56.60
B.S.I. Libertad	3.81	0.44	2.24	2.12	8.94	8.07	6.40	11.59	11.68	2.22	4.03	0.13	60.72	47.76	52.90
ORANGE WALK															
Hillbank	2.26	0.08	4.61	0.59	9.27	9.04	8.45	8.24	26.20	1.24	5.37	NIL	75.35	64.98	N.S
Yo Creek	2.34	0.37	4.64	0.63	11.30	7.04	6.65	6.16	20.91	4.10	3.19	0.07	68.40	55.23	S
BELIZE															
Londiver	3.10	2.14	11.63	2.37	8.04	6.90	5.92	10.24	9.50	3.33	10.77	0.81	76.05	64.09	N.A
Bze. International Airport	3.67	1.21	9.62	1.80	6.59	11.38	10.49	8.41	16.38	5.23	7.59	0.66	83.03	63.81	74.46
Gracie Rock	3.33	1.13	10.89	1.20	7.60	9.88	7.74	11.06	15.76	4.04	11.93	0.23	84.19	66.44	69.35
Haskell	2.93	0.55	5.18	0.48	9.83	10.62	6.09	6.92	19.69	5.68	5.14	0.03	72.54	70.03	72.33
Big Falls	3.25	1.01	8.44	2.34	8.75	14.05	9.03	7.68	20.66	4.07	4.53	0.36	84.19	70.25	N.S.
Ambergris Caye	5.23	1.33	8.07	3.96	8.75	5.26	5.32	6.12	5.57	2.76	9.68	0.59	68.64	54.19	N.A
CAYO															
San Ignacio	3.31	0.21	4.44	0.75	5.96	11.61	5.57	5.87	14.74	3.40	11.25	0.21	66.38	61.65	N.A.
Benque Viejo	4.51	0.51	4.54	0.60	7.96	7.29	8.91	9.31	14.29	3.73	6.59	0.29	62.53	N.A	N.A
Central Farm	1.96	0.62	4.66	3.32	4.75	6.59	9.19	8.03	15.09	5.06	6.54	0.06	65.73	53.52	58.61
Norland	2.79	0.37	6.03	1.69	5.22	7.86	9.31	8.72	15.31	5.52	7.61	0.10	70.63	56.46	60.90
Belmopan	3.83	0.43	10.21	1.25	6.79	8.62	11.35	15.24	22.50	4.57	9.16	0.73	94.73	76.33	N.S.
Augustine	3.49	0.91	4.06	2.92	8.09	7.57	3.94	8.01	15.98	9.73	10.58	1.43	76.76	60.80	63.31
Cooma Cairn	4.62	1.55	5.41	5.51	4.38	9.31	10.00	12.20	18.44	9.14	19.79	1.80	102.65	65.48	81.57
Sib n Hill	9.35	2.33	11.81	4.09	6.70	17.76	15.28	24.15	28.94	10.79	29.39	3.14	163.73	110.99	107.12
STANN CREEK															
Stann Creek Agstat	4.99	2.57	5.54	3.89	7.05	11.79	7.60	17.00	16.34	3.55	16.81	0.78	97.91	79.76	86.27
Pomona	5.47	2.49	5.60	2.11	8.70	9.02	8.55	19.53	20.76	3.57	16.03	1.47	103.30	82.47	94.75
Melinda Farm	4.33	2.52	7.25	2.42	6.03	10.43	5.32	16.54	12.91	3.36	N.A	1.00	N.A	68.41	N.A
Savannah	8.76	1.97	3.77	0.58	4.79	9.20	15.70	20.82	12.68	9.54	12.32	1.71	101.84	87.51	N.A.
Melinda ForestStation	4.33	1.24	6.13	4.47	7.36	13.39	6.30	17.24	16.08	3.45	15.79	0.81	96.59	74.53	N.S.
Middlesex	4.17	2.93	6.16	2.00	12.85	15.36	13.67	16.68	24.18	6.18	16.86	1.83	121.37	103.73	108.73
TOLEDO															
Punta Gorda Agstat	5.30	0.98	5.89	2.33	10.07	27.95	35.46	33.67	24.64	2.89	8.19	1.90	159.27	143.34	144.05
San Antonio	4.02	0.33	2.62	3.03	10.80	18.42	22.75	25.06	22.95	4.15	6.00	2.77	122.90	N.A.	N.A.
Machaca	5.16	1.10	3.01	2.05	8.09	22.41	31.14	24.51	18.35	7.91	7.91	1.80	133.44	143.06	127.07

RAINFALL IN INCHES
ALL READING TAEN AT 09.00 HOURS

APPENDIX 111

METEOROLOGICAL DATA 1969

MEAN MONTHLY TEMPERATURE °F

MONTH	BELIZE INT'L AIRPORT	ST. JOHN'S COLLEGE	YO CREEK AGSTAT	AMBERGRIS CAYE	CABBAGE HAUL	MELINDA FOREST STATION	CENTRAL FARM	AYGUSTINE PINERIDGE	COOME CAIRN	SIBUN HILL	SAVANNAH FOREST STATION	STANN CREEK AGSTAT	BIG FALLS	SAN ROMAN
JANUARY	82	82	84	84	93	84	84	76	72	72	84	82	83	84
FEBRUARY	85	82	88	86	93	86	96	81	75	75	87	83	NA	86
MARCH	84	84	88	NA	92	88	87	82	77	75	91	84	85	87
APRIL	88	88	97	88	92	92	91	86	82	85	95	87	90	92
MAY	89	90	93	90	NA	93	92	90	84	84	93	89	87	NA
JUNE	90	89	83	91	98	96	91	88	83	84	92	89	90	NA
JULY	89	86	84	87	94	92	88	87	80	NA	93	88	88	81
AUGUST	88	88	83	89	95	93	89	86	80	80	93	88	89	81
SEPTEMBER	88	88	NA	89	91	92	87	85	78	77	93	88	86	81
OCTOBER	88	87	83	88	94	93	89	84	78	78	91	88	89	74
NOVEMBER	84	82	NA	87	79	88	83	78	73	NA	84	83	85	75
DECEMBER	84	83	75	85	85	88	84	82	71	70	83	83	83	71

MEAN MONTHLY MINIMUM TEMPERATURE °F

JANUARY	68	69	43	72	55	67	65	58	61	61	69	65	68	60
FEBRUAR	69	73	65	73	56	68	63	62	61	63	68	65	NA	61
MARCH	72	73	70	NA	61	73	68	66	63	62	74	69	NA	NA
APRIL	76	77	69	75	62	76	70	67	67	67	74	71	71	NA
MAY	77	79	63	75	NA	79	73	71	68	74	77	73	65	NA
JUNE	77	78	62	74	67	78	73	71	69	69	73	73	72	NA
JULY	77	79	65	75	64	78	73	70	68	NA	78	73	78	NA
AUGUST	76	76	66	76	60	78	72	70	67	67	75	71	73	NA
SEPTEMBER	78	77	NA	77	73	78	72	71	67	67	75	72	75	74
OCTOBER	75	75	65	76	62	77	71	68	67	67	73	70	77	73
NOVEMBER	70	71	NA	73	70	71	67	66	62	NA	69	67	70	73
DECEMBER	68	70	65	72	64	73	63	62	60	62	68	65	69	68

ALL READINGS TAKEN AT 09.00 Hours.

Plant Pest and their Host

Of Belize (British Honduras)

	Local Name	Host		
ORDER.....COLEOPTERA				
FAMILY.....ANOBLIDAE				
Lasioderma serricome (F)	Cigarette beetle	* Tobacco leaf	Nicotiana spp.	
FAMILY.....BRENTHIDAE				
Arrhenodes flavolinestus (Gyll)	None	Rice	Oryza	sativa
Arrhenodes goudoti (Kirsch)	None	Rice	Oryza	sativa
Brentus anchorago (L.)	None	Corn	Zea	Mais
Rhaphirhynchus sp. ? Severini (Senna	None	Weed		
FAMILY.....BRUCHIDAE				
Acanthoscelides obtectus (Say)	Bean Bruchid	* Red Kidney Beans	Phaceolus	Vulgaris
Acanthoscelides sp.	" "	Milk Weed	Asclepias	sp.
Zabrotes subfasciatus (Boh.)	" "	Cow Pea	Vigna	Simensis
		Red Kidney Beans	Phaseolus	Vulgaris
FAMILY.....CANTHARIDAE				
Silis acantholobus (Champ.)	Soldier beetle	Yams	Dioscorea	sp.
		Corn	Zea	Mais
FAMILY.....CARABIDAE				
Lebia calliope Bates	None	Corn	Zea	Mais
Lebia anchora (chev.)	None	Coco yams	Tania	
Calosoma sayi (Dej.)	None	Cedar	Cedrella	Mexicana
FAMILY.....CASSIDIDAE				
Pseudomesophalia punicca (Bol.)	None	Mangla	Sesamum	Indicum
FAMILY.....COCCINELLIDAE				
Ceratomegilla maculata (Deg.)	None	R.K. Beans	Phaseolus	Vulgaris
Chilocorus cacti (L.)	None	R.K. Beans	Phaseolus	Vulgaris
Epilachna borelis (F.)	None	Cucumber	Cucurbita	sp.
		Sweet Pepper	Capsicum frutescens	
Epilachna borealis var discinta Wse	None	Cashew	Anacardium	Occindentale
		Cucumber	Cucurbita	sp.
		Rice	Oryza	Sativa
		Corn Plant	Zea	Mais

		Local Name	Host		
FAMILY.....CRIOCERIDAE					
Lema	Longicornis Chev.	None	Coco Yams	Xanthosoma	sp.
Lema	relucens Jac.	None	Coco	Xanthosoma	sp.
FAMILY.....CUCUJIDAE					
Cathartus	quadricollis guer	None	Corn	Zea	Mais
FAMILY.....CURCULIONIDAE					
Rhyncophorus palmarum	L.	Coconut veevil	Coconut	Cocos	Nucifera
FAMILY.....DYNASTIDAE					
Enema	endymion chev.	None		from Light	
Cyclocephala	signata F.	None		" "	
Megasoma	elaphas F.	None		" "	
Strategus	julianus Burm.	None	Coconut	Cocos	Nucifera
FAMILY.....ELATERIDAE					
Chalcolepidus	rugatus cand.	Wire Worm	Orange	Citrus	sp.
FAMILY.....EUMOLPIDAE					
Colaspis	freyi Bech.	None	Corn	Zea	Mais
Colaspis	hypchlora Lefev.	None	Okra	Hibiscus	esculentus
Colaspis	prasina Lefev.	None	Corn	Zea	Mais
Myochrous	tibialis Jac.	None	Corn	Zea	Mais
Nodonota	opacicollis Jac.	None	Corn	Zea	Mais
			Rice	Oryza	sativa
			Rose	Rosa	sp.
Typophorus	paradoxus Jac.	None	Corn	Zea	Mais
			Coco yams	Xanthosoma	sp.
FAMILY.....CALERUCIDAE					
Ceratoma	ruficornis Col.	None	* pepper	Capsicum	anum
			*sweet pepper	Capsicum	frutescens
			* cucumber	Cucurbita	sp.
			* R.K. Beans	Phaseolus	Vulgaris
			Corn	Zea	Mais
				Jasminum	sp.
			Coco yams	Xanthosoma	sp.

Diabrotica balteata (Lec.)	spotted cucumber beetle	*Cabbages, Lettuce, Cauliflower	Brassicas	sp.
		* Peppers'	Capsicum	sp.
		* Okra	Hibiscus esculentus	
		* R.K. Beans	Phaseolus	Vulgaris
		* Corn	Zea	Mais
		Calalu	Phytolaca	icosandra
Diabrotica flaviventris (Jac.)	Cucumber beetle	Corn	Zea	Mais
Diabrotica Lepida (say)	Cucumber beetle	Cucumber	Cururbita	sp.
		Calalu	Phytoleca	icosandra
Di brotica pulchella Jac.- Duv	Cucumber beetle	Milk Weed	Asclepias	sp.
		* Pepper	Capsicum anum	
		* Cucumber	Cucurbita	sp.
		Coco yams	Xabtgisina	sp.
		Corn	Zea	Mais
Diabrotica pulchra salib	Cucumber beetle	* Rice	Oryza	sativa
FAMILY.....HALTICIDAE				
Diphaulata aulica (ol.)	None	* Tomato	Lycopersicum	esculentum
		* R.K. Beans	Phaseolus	Vulgaris
		Coco yams	Xanthosoma	sp.
		Corn	Zea	Mais
Disonycha glabrata (F.)	None	Corn	Zea	Mais
Epitrix parvula (F.)	Flea beetle	* Egg Plant	Salanum	melongena
Epitrix sp.	Flea Beetle	*Tomato	Lycopersicum	esculentum
Homophoeta aeguinoctialis (L.)	None	Coco yams	Xanthosoma	sp.
Oedionychus clypeatus (Jac.)	None	* Okra	Hibiscus	esculentus
Oedionychus decemguttatus (F.)	None	Corn	Zea	Mais
Oedionychus tenuicinctus (Jac.)	None	Avacado Pear	Persea	sp.
		* Vangla	Sesamum	indicum
Systena say	None	Corn	Zea	Mais
		Sweet Potatoes	Ipomaea	Batatas
		R. K. Beans	Phaseolus	Vulgaris
Systena sp.	None	Pasture grass	Pasture	grass
		Coco yams	Xanthosoma	sp.
FAMILY.....HISTERIDAE				
Hololepta quadridentata F.	unknown	Coconut	Cocos	Nucifera
FAMILY.....HISPIDAE				
Chalepus bellulus chap.	unknown	Pasture grass	Pasture	grass

FAMILY.....HYDROPHILIDAE					
Hydrophilus ater s. sp. intern. J.duval		Unknown	Unknown		
FAMILY.....LYCIDAE					
Calopteron bifasciatum	(gorth)	Unknown	Pangola grass	Digitaria	decumbens
FAMILY.....MELOIDAE					
Epicauta vitticollis	(Haag)	Blister beetle	Spanish Towel	Luffa	aegypticca
			Tomato	Lycopersicum	esculentum
			P. K. Beans	Phascolus	Vulgaris
FAMILY.....MELOLONTHIDAE					
Cerapis pilatei	(Her.)	None	*Orange	Citurs	
Diplotaxis sp.		None	Pine	Pinus	caribaea
Phyllophaga sp.		None	Unknown	Unknown	
FAMILY.....NITIDULIDAE					
Carpophilus mutilatus	(Er.)		Corn	Zea	Mais
FAMILY.....PASSALIDAE					
Passalus interruptus	(L.)	None		Decaying	Material
Passalus punctatostriatus	(Perch)	None		"	"
Popilus striatopunctatus	(Perch)	None		"	"
FAMILY.....PRIONIDAE					
Callipogon senex	Dup.	None	* Orange	Citrus	sp.
			* Coconut	Cocos	nucifera
FAMILY.....RUTELIDAE					
Chlorota linbaticollis	(Blank)	None	* Casava	Manihot	utilissima
			* Banana & Plantain	Musa	spp.
FAMILY.....STAPHYLINIDAE					
Piestus pygmaeus	Lap.	Rove beetle	Corn	Zea	Mais
FAMILY.....TENEBRIONIDAE					
Strongylium auratum	(Cast.)	None	* Cedar Tree	Cedrella	Mexicana
Tribolium castanuem	(Herbst.)	Red flour bettle	* Stored Products	Stored	Products
ORDER.....DERMAPTERA		Local Name	Host		
FAMILY.....FORFICULIDAE					
Doru lineare (Eschscherich)		Ear wig	* Corn	Zea	Mais
			* Coco yams	Xanthosoma	sp.

	Local Name	Host		
ORDER.....DIPTERA				
FAMILY.....LONCHAEIDES				
Silba sp.	Fruit Fly	* Avacado Fruit	Persea	spp.
FAMILY.....MUSCIDAE				
Atherigona Orientalis (Schin)	Fruit Fly	* Pickle Worm	Dacpita	nitidalis
		* Onions bulbs	Allium	Cepa
FAMILY.....RICHARDIIDAE				
Richardia podagrica (Fab)	Fruit Fly	Cashew	Anacardium	occidentale
FAMILY.....STRATIOMYIDAE				
Hermetia illucens (L.)	None	(Scavenger) organic material		
Rhaeticus testaceus (Fab.)	None	Orange Fruit	Citrus	sp.
FAMILY.....SYRPHIDAE				
Volucella sp.	Hover Flies	Avacado fruit	Persia	sp.
		Orange fruit	Citrus	sp.
FAMILY.....TACHINIDAE				
Lesposia sp.	None	Army Worm	Spodophera	sp.
FAMILY.....TEPHRITIDAE				
Anastrepha cordata Aldrich	Mexicana Fruit Fly	Cra - boo	Drysomima	sp.
Anastrepha Ludens	Mexicana Fruit Fly	* Orange & Grapefruits	Citrus	sp.
Anastrepha Mombinpraeoptans Scin	Mexicana Fruit Fly	* Guava	Psidium	Guayava
		Cashew	Anacardium	occidentale
		* Hog Plum		
FAMILY.....ULIDIIDAE				
Chaetopsis aenea (Fab.)	None	Rice	Oryza	Sativa
Notogramma stigma (Fab.)	None	Cucumber	Cucumis	Sativus

ORDER.....HEMIPTERA	Local Name	Host	
FAMILY.....BELOSTOMATIDAE			
Belostoma subspinosum cupreomicans Stål	Water Bug		
Lethocerus medius (Guerin)	Walter Bug		
FAMILY.....CERCOPIDAE			
Aeneolamia postica (WLK)	Spittle Bug (Frog Hopper)	* Sugar cane	Saccharum officinarum
		* Pangola grass	Digitaria decumbens
		Velvet apple	Diospyros discolor
		Sweet potatoes	Ipomoea batatas
		* Rice	Oryza Sativa
		Sour grass	Paspalum conjugatum
		Corn	Zea Mais
	(Frog Hopper) Spittle Bug		Unknown
FAMILY.....CICADELLIDAE			
Apogonalia sp.	leaf hopper	Bread fruit	Artocarpus incisa
Baleluthe sp.	leaf hopper	R. K. Beans	Phaseolus Vulgaris
Cardioscarta pulchella Guer	leaf hopper	* Califlower	Brassica oleracea
		Corn	Zea Mais
Catagonia miniaticeps (Foul.)	leaf hopper	Bread fruit	Artocarpus incisa
		R. K. Beans	Phaseolus Vulgaris
		Cron	Zea Mais
		Sour Grass	Paspalum conjugatum
FAMILY.....DIEDROCEPHALA Sanguinolenta			
Draeculacephala sp. Fr. Mollipes (Say)	leaf hopper	Unknown	Unknown
Draeculacephala sp.	leaf hopper	Pangola grass	Digitaria decumbens
Empoasca kraemeri & Moore	leaf hopper	Pangola grass	Digitaria decumbens
Erythroneura arsolata sign.	leaf hopper	R. K. Beans	Phaseolus Vulgaris
		Bread fruit	Artocarpus incisa
		* Califlower	Brassica oleracea
		Hot pepper	Capsicum Annum
		Corn	Zea Mais
Erythrogonia jucunda (Walk.)	leaf hopper	* Bread fruit	Artocarpus incisa
		Califlower	Brassica oleracea
		Yams	Dioscorea sp.
		Velvet apple	Diospyros discolor
		Coco yams	Xanthosoma sp.
		Corn	Zea Mais

	Local Name	Host		
Erythrogonia laudata (Walk).	Leaf hopper	Breadfruit	Artocarpus	incisa
		Pigeon Pea	Cajanus	Cajan
		Hot pepper	Capsicum	annum
		Yams	Dioscorea	sp.
		Velvet apple	Diospyros	discolor
Graminella comata (Ball.)	Leaf hopper	Sour grass	Paspolum	Conjugatum
		Pangola grass	Digitaria	Decumbens
Gyponana sp.	Leaf hopper	R. K. Beans	Phaseolus	Vulgaris
Mortensia similis (Walk.)	Leaf Hopper	Sweet potatoes	Ipomaea	batatas
		R. K. Beans	Phaseolus	Vulgaris
		Pasture grass	Pasture	grass
Oncometopia clarior (Walk.)	Leaf Hopper	Bread fruit	Artocarpus	incisa
		* Orange	Foliage Citrus	sp.
		Yams	Dioscorea	sp.
		* Okra	Hibiscus	esculentus
		* R.K. Beans	Phaseolus	Vulgaris
		Avocado Foliage	Persea	sp.
Phera obtusifrons (Fowl.)	Leaf hopper	Rice	Oryza	Sativa
		Corn	Zea	Mais
Pseudophera sp.	Leaf Hopper	* Orange foliage	Citrus	sp.
		* Okra	Hibiscus	esculentus
Sibovia occatoria (say	Leaf hopper	R.K. Beans	Phaseolus	Vulgaris
Tylozygus fuscolcolus var.fronterae (Fowl.)	Leaf hopper	Sweet potatoes	Ipomaea	batatas
		Sour grass	Paspalum	Conjugatum
		R. K. Beans	Phaseolus	Vulgaris
FAMILY.....CICADIDAE				
Zammara calochroma (Walk.)	Dry weather criket	Bay Cedar	Guazuma	ulmifolia
FAMILY.....CIXIIDAE				
? Metabrixia sp.		Unknown	Unknown	
FAMILY.....COCCIDAE				
Coccus hesperidum (L.)	Scale insect	Orange plants	Citrus	sp.
FAMILY.....COREIDAE				
Acanthocephala granulosa (Dall.)		Sour orange	Citrus	aurantum
Anasa bellator (Fabr.)	Squash bug	Hot pepper	Capsicum	annum
		Corn	Zea	Mais

Anasa scorbutica (Fabr.)	Squash bug	Hot pepper	Capsicum	annuum
		Corn	Zea	Mais
Archimerus scuttelleris (Stål.)		Rice	Oryza	sativa
Capaneus odiosus (Stål.)		Orange	Citrus	sp.
Cimolus Vitticeps (Stål.)		Rice	Oryza	sativa
Hyalymenus tarsatus (Fabr.)		* Cashew	Anacardium	occidentale
		Orange	Citrus	sp.
		* Guava	Psidium	guyava
Hypselonotus concinnus (Dall.)		Wangla	Sesamum	undicum
Hypselonotus linearis (Stål.)		Corn	Zea	Mais
L ptoglossus gonogra (Fabr.)	Cinch bugs	Custard apple & Sour sop	Anona	sp.
		* Sour Orange	Citrus	aurantium
Leptoglossus stigma (Herbst.)		* Tomato fruit	Lycopersicum	esculentum
		* Guava	Psidium	Guyava
		* Cashew	Anacardium	eccidentale
		Orange fruit	Citrus	sp.
		Guava	Psidium	guyava
Pachylis lector (Stål.)		Corn	Zea	Mais
		Sensitive plant	Mimosa	sp.
FAMILY.....COREIDAE				
Phthia picta (DRU.)		Tomato fruit	Lycopersicum	esculentum
Sagotylus confluentus (Say)		Cow Pea	Vigna	sinensis
Sothonira sp.		Unknown	Unknown	
Zicca recurva Dist.		Orange	Citrus	sp.
		Rice	Oryza	sativa
Zicca taeniola (Dall.)		Wangla	Sesamum	indicum
		* Tomato	Lycopersicum	esculentum
FAMILY.....CYDNIDAE				
Cyrocnemis quadrisignata Stål		Soya Beans	Glycine	Max
		Calalu	Phytoluca	icosandra
FAMILY.....DELPHACIDAE				
Kolisia occidentalis (Muir.)	Leaf hopper	Sour grass	Paspalum	conjugatum
Peregrinus maidis (Ashm.)	Leaf hopper	* Corn	Zea	Mais
Saccharosydne rostifrons (Craw.)	Lead hopper	* Sour grass	Paspalum	conjugatum
Sogotodes orizicola (Muir.)	Rice Fly	* Rice	Oryza	sativa
Sogotodes sp.	Rice Fly	R. K. Beans	Phaseolus	Vulgaris
		Pangola grass	Digitaria	decumbens

	Local Name	Host		
FAMILY.....DERBIDAE		Sour grass	Paspalum	conjugatum
Cedusa sp.				
FAMILY.....DICTYOPHARIDAE				
Taosa herbida (Walk.)		Unknown	Unknown	
Nersia florens Stål		Unknown	Unknown	
FAMILY.....LYGAEDAE				
Blissus sp.		Rice	Oryza	sativa
Cryphula trimaculatus (Dist.)		Unknown	Unknown	
Ischnodemus sallei (Sign)		Corn	Zea Mais	
Melanocoryphus bicrucis (Say)		Yams	Dioscorea	sp.
Oncopeltus sandarachatus (Say)		Milk weed (Polly Red Head)	Asclepias	sp.
Pachybrachius Vinctus (Say)		Sour Grass	Paspalum	conjugatum
FAMILY.....MEMBRACIDAE				
Aconophora pallescens (Stål.)	Tree hopper	* Pa - paw	Carica	papaya
Antianthe expansa (Fowl.)	Tree hopper	* Pepper	Capsicum	spp.
Harmonides distinguenda (Fowl.)	Tree hopper	Orange	Citrus	sp.
Stictolobus minor (Fowl.)	Tree hopper	Lime (Beans)	Phaseolus	Lunatus
		Rice	Oryza	Sativa
		Plum	Sooudi-s	sp.
Tylopelta gibbora (Stål.)	Tree hopper	Lima beans	Phaseolus	Lunatus
FAMILY.....MIRIDAE				
Bothrophorella nigra (Stål.)		Sweet potatoes	Ipomaea	batatas
Engytatus Modestus (Dist.)		*Lantana	Lantana	camara
Garganus albridivittis (Stål.)		* Sweet Potatoes	Ipomaea	batatas
Halticus citri (Ashm.)	Flea hopper	* Tomato plan	Lycopersicum	osculentum
		*.R.K. Beans	Phaseolus	Vulgaris
Platylellus latipennis (Stål.)		Coco - Yams	Xanthosora	sp.
		Corn	Zea	Mais
FAMILY.....NOGODINIDAE				
Biolleyana pictifrono (Stål.)		Corn	Zea	Mais
FAMILY.....PENTATOMIDAE				
Acrosternum marginatum (P.B.B.)	Stink bugs	Corn	Zea	Mais
Disderia decorata (Dist.)	Stink bug	Orange	Citrus	sp.
		Rice	Oryza	sativa

Edessa cornuta (Burn.)	Stink bugs	Yams	Dioscorea sp.
		Rice	Oryza Sativa
Edessa sp.. ? laticornis (Stål.)	Stink bugs	Orange	Citrus sp.
Edssa rufomarginata de G	" "	Egg Plant	Soeanum melongena
		Corn	Zea mais
Euschistus bifiblus (P.S.B.)	Shield bugs	Okra bugs	Hibiscus esculentus
Euschistus crenator (Fabr.)	" "	Egg Plant	Solanum melongena
		Corn	Zea Mais
Mormidea pictiventris (Stål.)		Yams	Dioscorea sp.
		*Rice	Oryza Sativa
Mormidea ypsilon (Linn.)	Shield bugs	*Rice	Oryza Sativa
Proxus punctulatus (P.S.B.)	" "	Sweet potatoes	Ipomaea batatas
Sphyrocoris sp.	" "	*Lantana	Lantana camara
FAMILY:.....PSEUDOCOCCIDAE			
Phenacoccus sp. nr. Solani (Ferric)	Mealy bug	Sweet pepper	Capsicum frutescens
FAMILY:.....PYRRHOCORIDAE			
Dusdercus sp. ? Capitatus (Dist.)		Okra	Hibiscus esculentus
Dusdercus concinnus (Stål.)		"	" "
Dysdercus mimus (Say.)		"	" "
Fibrenus sp.		Orange	Citrus sp.
		Corn	Zea Mais
Largus varians (Stål.)		* Cashew	Anacardium occidentale
		*Sour Sap, Custard apple	Anona spp.
		*Barbados cherry	Eguenia Michilii
		Yams	Dioscorea sp.
		Rice	Oryza sativa
		*Guava	psidium guyava
		Corn	Zea Mais
FAMILY:.....REDUVIIDAE			
Apionemus anmumdus (Bergr.)	Assassin bugs	Predacious	Predacious
Rasahus hantus (Fabr.)	" "	"	"
epipta taurus (FAbr.)	" "	"	"
Zelus janus (Stål.)	" "	"	"
Zelus rubi.us (Lep.& Ser.)	" "	"	"
FAMILY:.....THYREOCORIDAE			
Gyrocnemis quadrisignatus (Stål.)		Egg plant	Solanum melongena

FAMILY.....TINGIDAE				
Corythuca fusciera (Stål.)	Lace - bugs	Chaya	Chaya	
Corythuca gossypii (Fabr.)	Lace - bugs		Casia	fistula

ORDER:.....HYMENOPTERA	Local Name	Host	
FAMILY:.....APIDAE			
Trigona corvina (CKII.)	Drunken Baymen'	*Orange	Citrus
		*Mango	Mangifera indica
		R.K. Beans	Phaseolus vulgris
		Pumpkin	Cucurbita pepo
FAMILY.....ENCYRTIDAE			
Anagyrus sp.	none	Honey dew	Honey dew
FAMILY:.....FORMICIDAE			
Atta cephalotes (L.)	Wee - Wee	*Bread fruit	Artocarpus
		Orange plants	Citrus spp.
			Erythrina spp.
		*Fig tree	Ficus spp.
		* Grass	Gramineae
		*Rusty shield bearer	peltophorum sp.
		*Flamboyant	Poinciana regia
Camponotus (Myrmonthrix) abdominalis (Fab.)	none	unknown	unknown
Camponotus (Myrmobrachus) plantus (Roger.)	none	Orange plant	Citrus spp.
Camponotus sp.	none	unknown	unknown
Cheliomyrex morosus (SM.)	none	"	"
Crematogaster sp.	none	"	"
Dolichoderus (Monacis) bispinosus (Oliv.)	none	Orange Plant	Citrus spp.
Ectatoma ruiduum (Roger.)	Ants	Honey dew	Honey dew
Monomorium floricola (Jerd)	Sugar ants	Domestic	Domestic
Neivamyrmex longiscapus (Borgm.)	none	unknown	unknown
Paratrechina logicornis (Latr.)	none	Honeydew	Honey dew
Pseudomyrma gracilis (Fab)	none	Rose	Rosa sp.
		Egg plants	Solanum melongena
Solenopsis geminata (Fab)	Fire ants	Domestic	Domestic
FAMILY:.....VESPIDAE			
Parachartergus apicalis (Fab)	Wasp	unknown	unknown
Polybia occidendalis nausicace (Richards)	Wasp	Unknown	unknown

ORDER.....LEPIDOPTERA	LOCAL NAME	HOST		
FAMILY.....ARCTIIDAE				
Argylla sp.	Tiger moth		Unknown	
Ecpantheria sp. nr. caudata (Wkr.)	Tiger moth		Unknown	
Ecpantheria sp. ? perplexa (Sch.)	Tiger moth		Unknown	
Eudesmia menea (Drury)	Tiger moth	Orange foliage	Citrus	sp.
FAMILY.....BRASSOLIDAE				
Opsiphanes tamarindi (Feld.)		Plantain foliage	Musa	sp.
FAMILY.....COSMOPTERIGIDAE				
Homaledra sabalella (Chamb.)		* Coconut palm	Cocus	nucifera
Sathrobrota rileyi (Wals.)		* Ornamental hibiscus	Rosa	sinensis
FAMILY.....GELECHIIDAE				
Sitotroga cerealella (Ol.)	Angoumois grain moth.	* Stored Rice grain	Oryza	sativa
FAMILY.....HESPERIIDAE				
Calpodes ethlius (Stoll.)	Skippers	*	Gramae	sp.
Perichares sp. ? deceptus (Btlr.)	Skippers	* Corn foliage	Zea	Mais
Perichares philetes (Gmelin)	Skippers	Plantain foliage	Musa	sp.
Quinta cannae (H.S.)	Skippers	Guatemala grass	Tripsacum	Laxum
Urbanus proteus (L.)	Skippers		Strelitzia	sp.
Wallengrenia Smith	Skippers	R. K. Beans	Phaseolus	Vulgaris
		Rice foliage	Oryza	Sativa
FAMILY.....NOCTUIDAE				
Cobubathra sp. (Nr. Metaspilaris WKR)		Corn	Zea	Mais
Heliothis Zea (Broddie)	Corn Ear Worm	* Corn ear	Zea	Mais
Mocis punctularis (Wb.)		* Pasture grass		
Plusia brassica (Riley)	Cabbage looper	* Cabbage	Brassica	
Spodoptera cridania (Stoll)	Fruit borer	* Tomato fruit	Lycopersicum	esculentum
Spodoptera frugiperda (Smith & A.)	False army worm	* Corn	Zea	Mais
		Sorghum		
Spodoptera latifascia (Wkr.)	Fruit borer	Tomato fruit	Lycopersicum	esculentum
Spodoptera ornithogalli (Gn.)	Cut worm	* Pepper	Capsicum	frutescens
		* Tomato	Lycopersicum	esculentum
		* Onion	Allum	cepa
Xanthopastis timais (Cramer)	None	Water hyacinth	Eichornia	crassipes
FAMILY.....MEGALOPYGIDAE				
Megalopyge tharops (Stoll)	None	Avocado foliage	Persea	sp.

FAMILY:.....OECOPHORIDAE	Local name	Host	
Himmacia sp.	none	Guava	Psidium guyav
FAMILY:.....PAPILLIONIDAE			
Papilio anchisiades	Orange dog	Orange foliage	Citrus spp
Papilio thoas (L.)	Orange dog	Orange foliage	Citrus spp.
FAMILY:.....PEIRIDAE			
Ascia monuste	Cabbabe butter fly	*Cabbage	Brassica oleracae gemifera
FAMILY:.....PLUTELLIDAE			
Plutella maculipennis	Diamond back moth	Cabbage Cauliflower	Brassica spp.
FAMILY:.....PYRALIDAE			
Diatraea impersonatella (walk.)	Cob borer	*Corn cobs	Zea mais
Diatraea Lineolata (WKr.)	Stalk borer	* Corn	" "
Diatraea (F.)	Rice Stem borer	*Rice Stem	Oruza sativa
Diatraea tavernella (Duar)	Stem borer	Rice stem	Oryza sativa
Ephastia coutella (Walker)	Grain moth	*Stored grains	
Lamprosema indicata (F)	Leaf tier	*Logumes	
Palpita lucidalis (Hb.)	Pickle worm	*Pumpkins	Cucurbita sp.
Palpita nitidalis (Cr.)	Pickle worm	*Cucumber	Cucumis sativa
Psaba phoopteralis (GN)		*Tomato foliage	Hycopersicum esculentum
Rupela albinella (Cr.)	Stem borer		
FAMILY:.....SATURNIDIIDAE			
Adolocephala quadrilineata (Grote)		unknown	
Adolocephala quadrilineata (Grote)		unknown	
Adelocephala quadrilineata (Grote)		unknown	
Adelocephala xanthochroia (Dyar)		unknown	
Arsenura armida (Crammer)		Bay cedar	Guazuma ulnifolia
Dirphia sp.		Gueen of flower	Lagerstrocimia indica
Rothschildia Leveau (Guer) subsp. Aroma Schans			
FAMILY:.....SPHINGIDAE			
Epistor ocypere L.	Hawk moths	unknown	
Erinnis ello L.	" "	unknown	
Manuduca lanugionsa Edw.	" "	unknown	
Pachylia ficus L.	" "	unknown	
Pachylia resumens walk	" "	Ivy fig	Ficus sp.
Perigonia lusca F. ilus Boid	" "	unknown	
Pholus anchemolus Cr.	" "	"	

	Local Name	Host		
ORDER.....MEGALOPTERA				
FAMILY.....CORYDALIDAE		Unknown		
Corydalus sp.				
ORDER.....ORTHOPTERA				
FAMILY.....ACRIDIDAE				
Dichroplus sp.	Grass Hopper	Rice	Oryza	sativa
Orphuella sp.	Grass hopper	Rice	Oryza	sativa
Schistocerca pectoralis (Walk)	Grass hopper		Pasture	grasses
Taeniopoda superba (St.)	Grass hopper		Dolichos	lablab
			Cocos	Nucifera
Tropidacris imperialis (P.S. Souss.)	Grass hopper		Pasture	grasses
FAMILY.....BLABERIDAE(DICTYOPTERA)				
? Blaberus atropos (toll)	Roach			
FAMILY.....BLATTELLIDAE (DICTYOPTERA)				
Blatella germanica (L.)	German Roach	Domestic	Domestic	
FAMILY.....BLATTIDAE (DICTYOPTERA)				
Periplaneta australasiae F.	Roach	Domestic	Domestic	
FAMILY.....GRYLLIDAE				
Cryllus assimilis (Fabricius)	Cricket			
? Gryllus comptus (Walker)	Cricket			
? Miogryllus pusillus (Burmeister)	Cricket			
FAMILY.....MANTIDAE (DICTYOPTERA)				
Stagmomantis sp.	Preying mantis			
FAMILY.....TETTIGONIIDAE				
Orophus sp.	Katydid	Orange	Citrus	sp.
			Hibiscus	sp.
Conocephalinae				
Conocephalus spp.	Long horned grass hopper	Rice	Oryza	sativa

Protamkulyx Strigilis (L.)	Hawk Moths	Cashew folinge	Anacardium	Occindentale
Psuedosphinx tetrio	Hawk Moths	Frangipani	Plumeria acutifolia	
FAMILY.....STENOMIDAE				
Stenoma sp. Nr. Catonifer (Wals.)	Fruit borer	Sour Sap fruit	Anona	muricata
		Avocado fruits	Persia	spp.
Stenoma sp. Nr. Strophalodes Meyr.	Fruit Borer	Sour Sap fruit	Anona	muricata
Stenoma sp.	Fruit borer	Rice stem	Oryza	Sativa
FAMILY.....TORTRICIDAE				
Gymandrosoma tortricornis Meyr.	Borer	Cra Boo	Brysomima	sp.
Olethreutes sp. ? Sideroptera Meyr	Borer	Cra Boo	Brsomima	crassifolia